THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVI. No. 1691.] LONDON, OCTOBER 8, 1895. [47TH YEAR. PRICE 6d.

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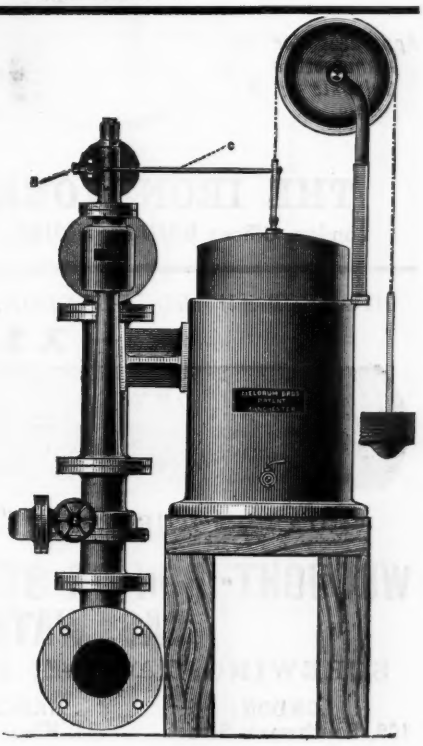

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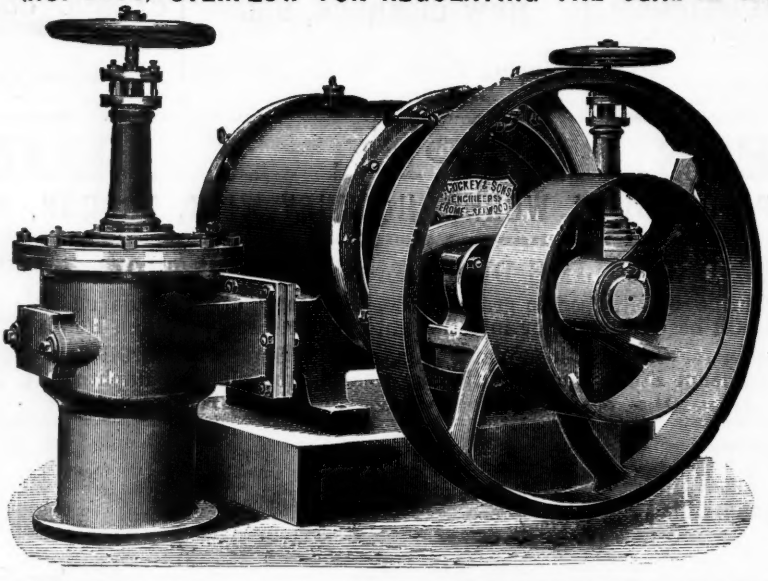

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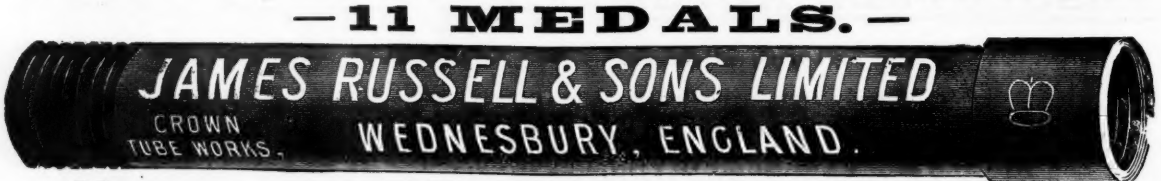

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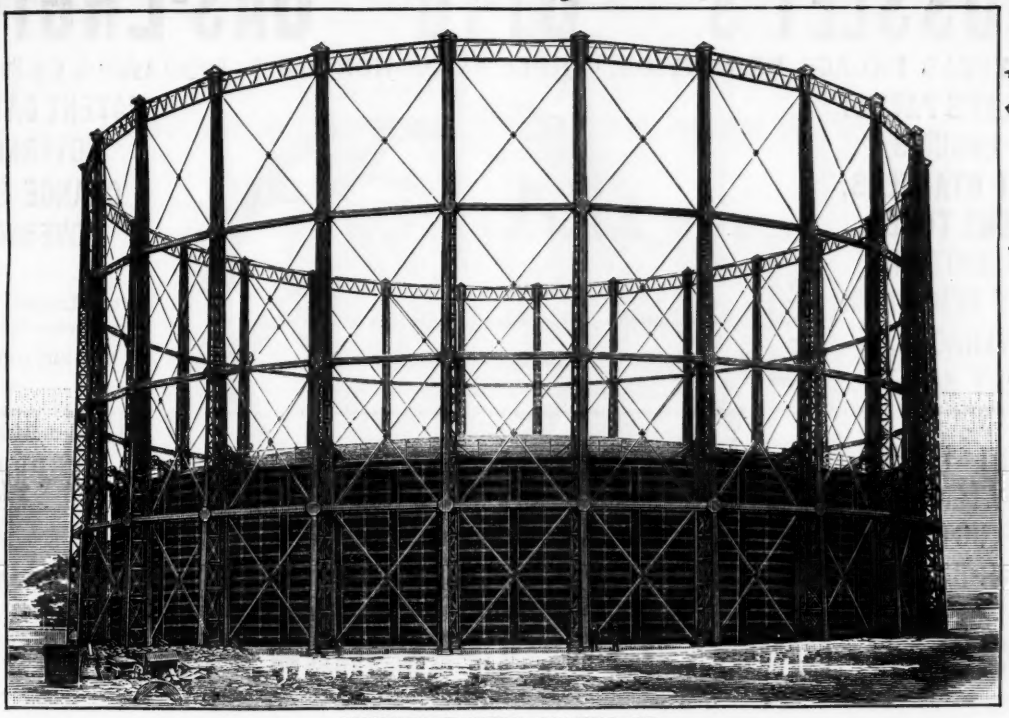

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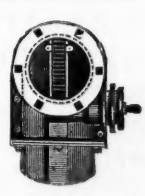

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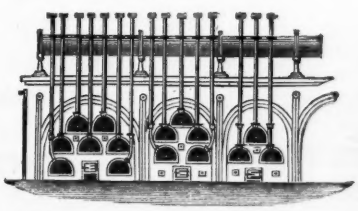

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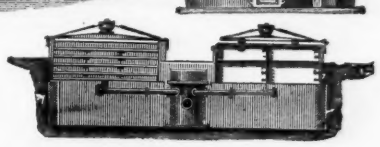

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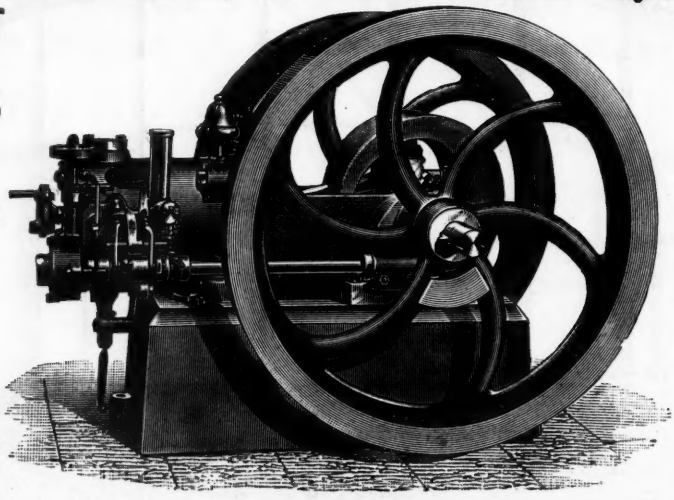

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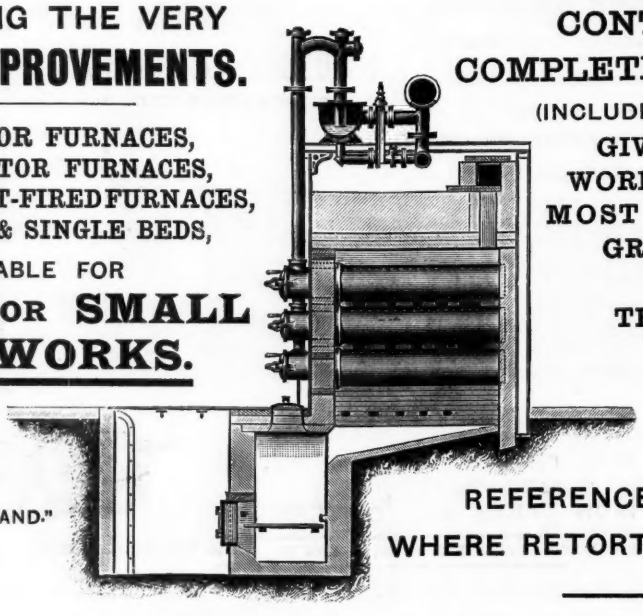

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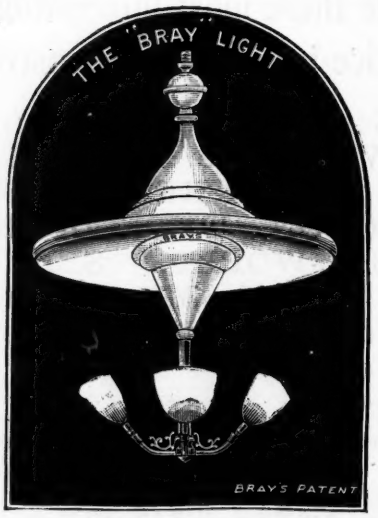

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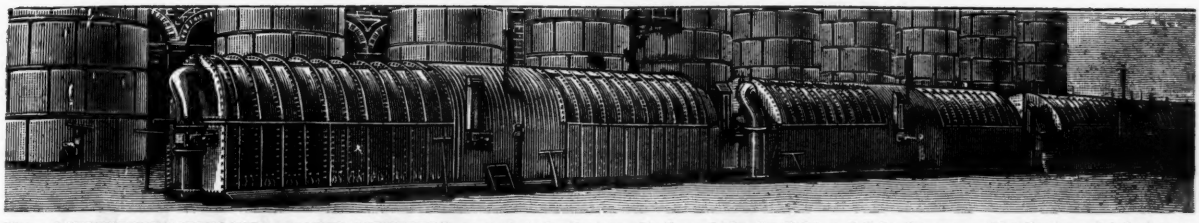

View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have **30** of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

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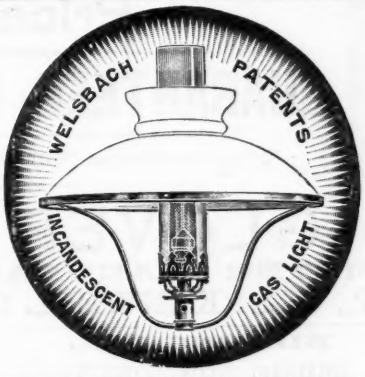

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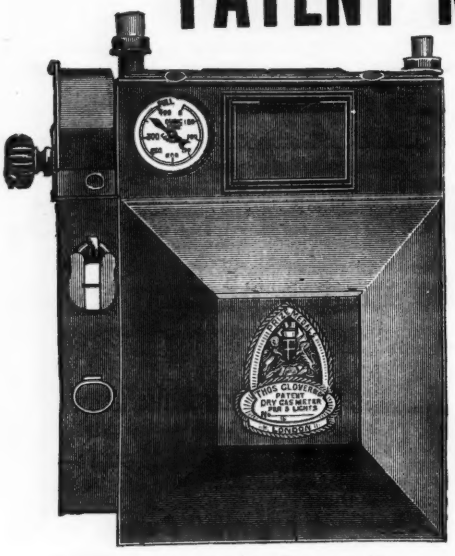

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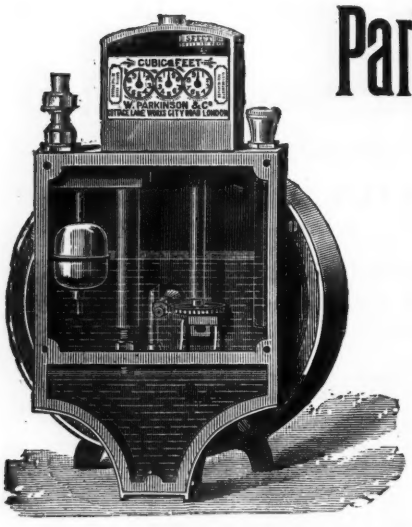

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Will stand very high pressures.

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Allows for loss of water by evaporation without materially affecting the registration or shutting off the gas.

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[See also Advt. p. 760.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Mr. Livesey on Gas Capital.

THE important letter of Mr. George Livesey upon the question of gas finance recently raised in these columns should be carefully studied by every gas director in the land. We have little to say about it, for the reason that most of the points made by Mr. Livesey are unanswerable. We take the opportunity of assuring our valued correspondent that there is no Socialism in the views entertained and expressed by us with regard to the case for making all gas capital redeemable. The two articles we have devoted to the question differ in character, as every reader will have noticed for himself. The first merely put the query as to why there should be such a radical difference in the status of the two kinds of gas capital; and the second showed the bearing of the inquiry upon gas companies' prospects, and threw out a few confessedly crude suggestions with a view to putting the problem in a perfectly fair light. Perhaps there was some ambiguity about the statement singled out for criticism by Mr. Livesey. We never contemplated the extinction of the proprietary rights of gas shareholders by paying off the whole capital. Obviously, if this were done, the undertakings would not belong to anybody; so that it would be worth nobody's while to look after or to keep them going. It is always difficult to convey one's meaning perfectly, when the idea sought to be expressed is a mere generality, and novel at that. What we meant by the sentence in question may be better understood if the word "all" in it is not taken in the sense of "the whole," but of "all classes" of capital.

Corporations cannot wipe out all their gas capital; for there will always be some wanted to carry on with. The really practical issue of the problem we have stated is that municipalized gas undertakings must inevitably gain a march upon gas companies by the steps imposed upon the former for reducing their gas capital; and it appears to be quite true, as Mr. Livesey to-day observes, that the average gas director is regardless of all such considerations. If gas companies' capital were brought down, as Mr. Livesey recommends, to the equivalent of the real assets, there would not be so vast a discrepancy between the burden of capital in their case and that which the ordinary municipalized gas undertaking has to carry. There is nothing, it is true, to prevent a municipality from paying off everything down to the latest loans; but as against this the capital expenditure of the average municipality tends to be higher than that of the average gas company working under modern conditions. That is to say, the company will, as a rule, be better administered. This is an assertion that will be contested in their own minds by some of our readers, if not in the publicity of print. But we maintain it; and the only exceptions that can be effectively cited to the contrary only prove the rule. Doubtless there are well-administered municipal gas undertakings and badly-administered gas companies, the sliding-scale and auction clauses notwithstanding. Yet it is generally found to be true that the standard of gas administration and management does not tend to rise under municipal auspices. It cannot do so while local authorities dilute their gas making with politics, cut down salaries, and convert their establishments into hotbeds of corruption—petty corruption, as yet, but still corruption for all that. On the other hand, as Mr. Livesey truly says, there is a great deal of nonsensical, expensive pretence about the administration of many gas companies. All the best average capitalist-director can do for his company is to know a good manager when he sees him; and if he is able to do as much, he is well worth his fees, even though these average £15 an hour. At the same time, there is usually an extravagant amount of "gilt-edging" to the Board, consideration being had to the slight value of the common kind of directorial performances, beyond that division of ultimate responsibility which is due to the management. There have been several modern instances that could be cited to show up Boards of Directors in the character of a set of broken reeds.

Gas Affairs in Liverpool.

THE Corporation of Liverpool have taken a further and a most extraordinary step in the attack they are making, under the leadership of Mr. Alderman Smith, upon the Gas Company. The "Memorandum" issued by the Special

Lighting Committee respecting the illuminating power and other circumstances of the gas supply of Liverpool and other towns, to which reference was made in this column last week, was brought by Alderman Smith under the notice of the City Council at their meeting last Wednesday; and any value that might have attached to the statements therein contained, so long as it was possible to regard it as a *bonâ fide* compilation, was effectually destroyed by the unblushingly partisan aspect that was put upon it on this occasion. Immediately upon this, the Alderman moved the following resolution: "That, in view "of the high price paid for coal, &c., used by the Liver- "pool United Gaslight Company, and the consequent high "price of gas and coke, the Town Clerk be and he is here- "by instructed to do all that is necessary to enable the "Council to promote a Bill in the forthcoming session of "Parliament to obtain powers to establish and maintain a "competitive gas supply, and that Standing Order No. 61 "be suspended accordingly." We give the resolution in full, in order that such a fine example of the practical good sense that for the present rules the corporate authorities of Liverpool shall be put upon record in these columns. The motion was carried unanimously. We do not know the nature of the Standing Order that had to be suspended to enable Alderman Smith to bring on his motion; but it might be to the effect that the Corporation of Liverpool are not to be made to occupy a false and ridiculous position at the bidding of any member of the Council, judging from the consequence that ensued upon Alderman Smith's action. It has been suggested by a local newspaper that the adoption of the resolution and most of the other proceedings of the Council at this particular meeting were not business, but merely manœuvring to catch votes at the approaching municipal elections. The language used by Alderman Smith in support of his case certainly sounded more like an "appeal to the gallery" than an argument for the specific course to which he wished to commit the Corporation. How little seriousness underlay the whole tirade can be perceived from the orator's own admission that no real damage to the Company was intended by the proposal to establish competitive municipal gas-works. We cannot, at any rate, spare space for discussing the position which serious action upon Alderman Smith's resolution would create both for the Corporation and the Company. The present City Council appear to be the laughingstock of sober citizens; and it is to be hoped that, when the elections are over, Liverpool may find itself equipped with a more rational set of rulers. One local newspaper seems to think it expresses this popular view of the situation in remarking that the Company "wants, "at least, a thorough shaking up." At the same time, there is not the smallest evidence that the ratepayers as a whole, or any considerable section of them, would approve of the gas supply being confided to such a Corporation as the city gets provided with nowadays. It would be an insult to the people of Liverpool, who cannot be supposed to be destitute of common honesty and commercial capacity, to imagine them to be desirous of ruining the Gas Company, even if the Legislature would sanction any proceeding calculated to have such an effect. A few ignorant voters may be caught by tirades against monopoly, and laudation of the principle of competition in gas supply. But it is only necessary to look across to their neighbours on the other side of the Atlantic ferry to see what the latter means in action. Alderman Smith may think he knows why Liverpool gas stands at its present price. Let him find out what the commodity costs in New York, Brooklyn, or Boston, and why.

The Commercial Gas Company's Meeting.

THE meeting of the Commercial Gas Company on Thursday was, as usual, brief and uneventful. The Chairman, Mr. J. Blacket Gill, did not detain the proprietors with a long speech, but ran through the principal entries in the accounts, and assured his auditory, in conventional terms, of the sound condition of the undertaking. He did not respond to our invitation to tell the world what the Commercial Board think of the sulphate market; and Mr. H. E. Jones, the Company's Engineer and General Manager, also passed very lightly over this delicate subject, in the pointed little speech which, as usual, he made in response to the complimentary vote of thanks to himself and the engineering staff. Yet it must be very annoying to engineers and works' managers to find the fruit of their labours half spoilt by the result of mercantile dealings which are more than suspected to have been prejudiced by sheer bungling somewhere. A cynic might say that it is a pity sulphate will not burn, otherwise a timely conflagration might be hoped for to clear the stocks that have acted like an incubus upon the markets ever since some would-be clever operators undertook to impose their own terms upon buyers—only to "get left" upon the mountains of their own raising. Curiously enough, the beet sugar crop of the Continent is reported this year to be 1,200,000 tons short. Is this due in any degree to the circumstance of the manure that should have long ago been sold and put upon the sugar lands being still kept in reserve?

The Gas Supply of Dublin and Edinburgh.

THE Alliance and Dublin Consumers' Gas Company have had a favourable half year, and expect to do still better; the immediate consequence of which is a reduction in the price of gas of 2d. per 1000 cubic feet. By a coincidence, the Edinburgh and Leith Gas Commissioners find themselves in a position to make an exactly similar reduction of price; so that the two national capitals of Ireland and Scotland for once find themselves "in the same boat." Both Dublin and Edinburgh have increased consumptions; but the growth of the output in Edinburgh and Leith is extraordinary and unprecedented. Dublin has only just recovered the increased cost of working due to the adoption of the eight-hour shift; and the Chairman explains that it was to this, and not to dearer coal, that the last rise of price is attributable. Most gas companies had about the same time to pay more for their coal; but the Chairman took credit to the Board from the circumstance that just then the Company had three years' contracts running at very low rates, "which the consumers got the benefit of." The latter observation is undoubtedly true; but it should not be overlooked, in connection with this testimony to the value in some circumstances of long coal contracts, that the advantage might just as easily have been to the other party. The Chairman of the Dublin Company probably does not expect, and certainly does not get, thanks for that benefit to the consumers of which he spoke; but if he had been in the awkward predicament of having to apologize for paying more than the market price for coal under a long contract, he would hear of it.

The Meeting of the North of England Association.

THE members of the North of England Association of Gas Managers met at Hexham on Saturday, under the presidency of Mr. Herbert Lees, the Manager of the Hexham Gas Company, whose Inaugural Address will be found in another column. Mr. Lees has succeeded in educing from his Hexham experiences and observations data which will be found of more than local interest and value. His treatment of the question of meter-rents is a good example of this. A diligent reader of his JOURNAL, Mr. Lees took an opportunity for mentioning with approval an article that appeared in our columns eight years ago. We take this as a great compliment, and more—it is these evidences that his cogitations and labours are not as water poured upon the sand which encourage the journalist in his work. The paper read at the meeting was by Mr. J. Holliday, of Scarborough; and the subject was "The Encouragement "of the Small Consumer." Curiously enough, the President's address had made it clear that the term "small "consumer" often covers a class of customer who is not particularly worthy of special consideration. Mr. Holliday, of course, had in view the deserving type of small consumer —the cottager. The most prominent feature of the paper was the proof it supplies that even monthly collections of rental do not impair the popularity of the prepayment meter. Besides this, it is full of most valuable information respecting the working of the latter system, well put together, and instructively treated. There can be no question of the utility and vitality of a Gas Managers' District Association that can command a supply of addresses and papers of the quality of those read at Hexham on Saturday. The meeting was otherwise successful; and the proceedings concluded with a dinner provided by the hospitality of the Directors of the Hexham Gas Company.

The Scottish System of Assessment.

AN interesting account of the rating system followed in Scotland, as compared with English practice in the same regard, appeared in last week's number of our contemporary *London*. It is observed in this article that the

Scottish rating system is remarkable for doing without many elements that bulk very largely in the English system. To begin with, in Scotland there is no Assessment Committee, and no such factor as "rateable value." There is only one column of figures opposite the names of the hereditaments inscribed (say) in the Glasgow valuation roll, and this is called the "yearly value," which is, broadly speaking, equivalent to our "gross annual value." Hence there can be no question of statutory or other deductions. The whole of Glasgow is valued by an expert, who is styled the City Assessor, and is at the head of a large department of the Corporation. There is no opportunity here for the legal and expert revelling over a quinquennial valuation, as in London; for the institution does not exist. The City Assessor simply prepares a new valuation roll every year; sending to each ratepayer a notification of the amount in which his property is assessed. If any objection is raised to the valuation, the same official hears it in the first place, and gives every facility to those who would induce him to alter his opinion. After the roll has been settled and signed by the Assessor, an appeal will still lie to a special Valuation Appeal Court, constituted of a Committee of Magistrates; and beyond this authority again to the Law Courts, on points of law. It thus appears that the Scottish system of assessment, as carried out in Glasgow, has very great advantages over the English manner of attaining the same object, in the points of simplicity, celerity, and economy. Such a scandalous proceeding as was the last Gaslight and Coke appeal to the Middlesex Sessions, costing nobody knows how much a day, would be impossible in Scotland. The ordinary Scottish Assessors, moreover, are not troubled with the valuation of gas and water undertakings, railways, or canals, which are remitted to a special Assessor, whose whole time is devoted to the work, and whose office is in Edinburgh. All this sounds very direct, businesslike, and cheap; and yet the Scottish ratepayers are quite as much dissatisfied as their southern fellow-victims. Though there is no published dual valuation, as between gross annual and net rateable value, yet in Scotland as in England it is necessary to work out an estimate of value very much after the same principle of deducting certain allowances from the gross valuation; and the same inequalities of rating occur. And still the ratepayer accuses the rating authorities of squeezing him. Gas and water mains, moreover, like railways, appear to be assessed by mileage, and not by their earning capacity. Thus the Corporation of Glasgow have water-mains passing from the source of supply in Loch Katrine through the parish of Aberfoyle—the land covering the pipes being cultivated and rated just as it was before the mains were laid. Yet the Corporation are made to pay two-thirds of the whole rate collected in Aberfoyle, through being assessed, as hypothetical tenants of the mains in question, upon the basis of 3 per cent. on the capital cost of laying them. One would like to hear of an assessment system free from little weaknesses such as this.

The Winter Instructions of the Metropolitan Gas Referees, which were issued last week, contain the usual intimation that the maximum quantity of sulphur permissible in gas will, until further notice, be 22 grains per 100 cubic feet.

A Correction.—With reference to the paragraph in the JOURNAL last week (p. 674) in regard to the presentation to a servant of the Glasgow Gas Trust, we are asked by our informant to mention that the name of the recipient was Taylor.

Personal.—We regret to learn, from the *Jewish Chronicle* that Sir Julian Goldsmid, Bart., M.P., feels himself constrained, owing to the state of his health, to considerably lighten his public work; and that, with this object in view, he will withdraw from several of his offices in and out of the community. His resignation of the presidentship of the Anglo-Jewish Association has, we understand, already been placed in the hands of the Council. While expressing regret at the cause which has led Sir Julian to take this step, we must offer him hearty congratulations on the distinction which has just been conferred upon him by his admission to Her Majesty's Most Honourable Privy Council. Mr. Harry Kendrick, assistant to Mr. S. Y. Shoubridge, of Salford, and formerly assistant to Mr. H. Hack, of Saltley, Birmingham, has been appointed Manager of the Stretford Gas Company's works; and he will enter upon his duties this week. Mr. Frederick Gibson, who has been for ten years in the Manager's office at the Carlisle Corporation Gas and Water Works (five years as pupil to Mr. Hepworth, and five years as assistant), has obtained the appointment of Engineer and Manager of the Chelmsford Gas Company, which was advertised in the JOURNAL a few weeks ago. There were 81 applications for the position.

WATER AND SANITARY AFFAIRS.

"VERY little public interest appeared to be taken in the "proceedings." Such was the statement given in *The Times* concerning the opening day of the Local Government Board inquiry relative to the recent deficiency in the supply of water to the East London Company's district. Commencing on Tuesday, the inquiry came to a close on Saturday, except that an inspection of some of the fittings, and a visit to the works, will take place on Thursday. As for the interest taken in these proceedings, that has its real centre at Spring Gardens. The County Council are seeking to gain their own ends; and the public can scarcely be expected to feel very deeply concerned as to the manner in which the pursuit is conducted. When things take a more practical shape—if ever they do—some amount of excitement may arise. We should like to know what benefit the East-end of London can hope to derive from the examination of a number of witnesses before Colonel Ducat and Dr. Barry at the Hackney Town Hall. The County Council are attacking the London Water Companies through the medium of one of them. That is the whole of the story. It is not a question of how much water shall be given to East London, but who shall give it. The Vestries make a fuss—the sapient authorities who watered the roads when the people are said to have "stormed the water-carts" with pails and cans to get a supply for domestic purposes. But all the present inquiry can do is to underline a set of facts already on record. In the archives of the Local Government Board there is a report by Major-General Scott, written at the close of 1887, which points forward, as clearly as anything could point, to the trouble which has beset the eastern part of London during the past summer. Thus we read: "On a general view of the whole circumstances, it seems "evident that the question of the water supply of the "North and East of London has entered a critical stage; "and it may be said that the restriction in the supply, "found necessary by the East London Company during "the past summer, was a premonitory symptom of diffi-"culties which in future seasons of scanty rainfall "will be more severely felt." So it has come to pass. But why was it ever allowed to do so? Viewing the rapid increase of the East London population, General Scott was afraid of what might happen by the year 1892. But what were the East London Company doing? Were they content to let matters slide, so long as they could earn "fat" dividends? though their dividends were not so particularly fat after all. The Company knew the danger, and sought to guard against it. The evidence given by Mr. W. B. Bryan, the Chief Engineer to the Company, is conclusive to this effect. He states that "from 1890" he had considered the question of further storage, and in 1891 the Company took action by purchasing ninety acres of land for the purpose of adding to their reservoirs. He brought the question of storage before the Royal Commission in 1892, and he felt the matter was urgent.

That the Commission under Lord Balfour of Burleigh accepted Mr. Bryan's view of the situation is well known. Greater storage capacity was declared to be requisite in order that East London might have an adequate supply. But how did the County Council behave in this matter? To what extent did they assist in warding off the peril which was seen to be approaching? Mr. Bryan states that on March 16, 1893, in a conference between the Council and the Company, the former, though "solemnly "warned" of the risk that would be incurred, absolutely refused to give their consent for money to be raised to provide fresh storage works and pumping machinery. Yet we have been coolly told again and again that the Company did not propose in 1893 to construct any new works, and, if they did, the objections of the Council had no reference to the works, but to something else. It is perfectly clear that the Company did intend to construct extensive storage works, with the requisite pumping machinery. But the Council refused to concede anything more than the raising of money to lay new mains for a period of two years. Now we find it argued before the Government Inspectors that the Company should have constructed the works out of revenue, and cut down their dividends. We should like to know how this was to be done, when half a million of money was wanted. What is the present position of the Company? Struggling with frost in the winter and drought in the summer, they

have seen the reserve fund dissipated, and the dividend reduced. That there is a fair prospect for the future is due to no goodwill on the part of the Council. Despite the opposition encountered in that quarter, Parliament has given power to the Company to raise the half million, and to construct the requisite works, with a stipulation that no time shall be lost. Had the power been given a year earlier, the recent drought would have been successfully met, and the present inquiry would never have been asked for. The Council fought hard against the Company's Bill in 1893, and obtained its rejection. Let us hear what Mr. Binnie, the Chief Engineer to the Council, has to say on this subject in his evidence before the Inspectors. He repeats the fallacy that in the Bill of 1893 "no specific "works were mentioned." But the ninety acres of land had been purchased two years before; and, according to Mr. Bryan's evidence, delivered subsequently to Mr. Binnie's, it was in March, 1893, that the conference was held at which the Council refused to give their consent to the raising of money for fresh storage works and pumping power. Apart from Mr. Bryan's evidence, it is perfectly well known that the Company proposed to expend the money in the extension of their reservoirs, and in other works necessary to the maintenance of the supply. There might be no plans and sections, neither were these required, though this is probably Mr. Binnie's sole warrant for saying that "the 1893 Water Bill of the Company "contained nothing pledging it to carry out the works." "It was purely a Money Bill," says Mr. Binnie, "and "contained provisions as to fittings to which the County "Council objected." But Mr. Binnie did not know, what he should have known, that these provisions were withdrawn before the second reading came on. He also denies that if new works had been authorized in 1893, the reservoirs would have been ready before the drought of 1895. Yet Mr. Bryan states that, under the Act of 1894, a new reservoir—representing 200 million gallons—will be ready in January next. This would, therefore, have been a year earlier had the Bill of 1893 been allowed to pass. The story of the "shattered mains" is also disposed of by the circumstance that all the damaged mains were repaired by the middle of April.

We might pursue Mr. Binnie's evidence further, and show how the opinions which guided him in objecting to the Company's plans were in direct opposition to the conclusions and recommendations of the Royal Commissioners. But the report of the Local Government Board Inspectors is to come, and our remarks to-day must needs be limited. We would say a word, though briefly, as to the excellent address delivered at the half-yearly meeting of the East London Water Company last week, by the Chairman, Mr. George Banbury. In that address, marked by moderation as well as by vigour, a distinction is drawn between the Council and the Progressives who, by a process of "gerrymandering," have managed to secure a predominance which does not rightfully belong to them. The day may come, though we fear it is remote, when the Council will be better constituted, and when a working majority of the members will maintain a policy worthy of a great municipal authority. The determination of the Council last Tuesday to take proceedings against the East London Company for recovery of penalties, marks what may be properly called a spirit of "relentless hostility." Mr. Beachcroft did well to move his amendment; but he argued in vain against the party which appears to consider everything fair in a fight against the Water Companies. There is even to be another Local Government Board inquiry, instigated by the County Council, and commencing on the 31st inst. This has reference chiefly to closet-flushing cisterns, and affects all the Companies.

Mr. Lass's Analysis of the Metropolitan Water Companies' Accounts, for the year ended Dec. 31, 1894, and March 31, 1895, has now been issued. This is the fifteenth year of publication of this useful compilation, the value of which at the present juncture will be specially appreciated by those who are occupied with the Metropolitan Water Question.

Death of Mr. A. Fraser.—We regret to record the death, on Sunday morning, of Mr. Alexander Fraser, M.Inst.C.E., the Chief Engineer of the Grand Junction Water Company. Mr. Fraser had been for many years connected with the Company; and, as our readers will remember, he was associated with Mr. W. Hunter, M.Inst.C.E., one of the Directors, in the preparation of the large scheme of water storage at Staines which was brought before Lord Balfour's Commission.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 750.)

THE pleasant rise in prices which has been going on so gaily for some time past in the Stock Markets received a severe check last week; and not too soon either, if only to remind people that even a balloon cannot go up for ever. The tone was, of course, set by the mining market, where buying orders ceased, and something like a rush to realize set in. Some people will be hard hit; but the general position will be a deal healthier for some abatement of this feverish speculation. If it were not checked in time, the ultimate crash would be terrible. Foreign affairs also have been disquieting; China, Madagascar, and Constantinople being focuses of anxiety. Thus prices have fallen all round, except in that Happy Valley the Gas Market, where they rose buoyantly. And there is this difference to be noted, that the rise in gas stocks is genuine, the result of a *bonâ-fide* demand for money investments. Business was pretty active during the week, especially in Gaslight "A," which was remarkably steady; stock changing hands every day at about 295½, or a shade better. The secured issues improved upon their advance of the previous week, with a further rise in the "J" 10 per cent. But transactions were much quieter. There was more activity in South Metropolitans; and the "B" and "C" stocks seemed to command any price in reason. The "C" has now left the 4 per cent. price behind it, like the "B." No business was done in Commercials; there appearing to be no stock in the market. The Suburban and Provincial Companies again had a record week of inactivity; not a single transaction being marked in any one of them. But Brentford new had a nice advance, though why there should be such a discrepancy between the prices of the old and the new is a mystery. Business was more moderate last week in the Continental undertakings. Imperial was fairly firm and unchanged; but Union had another considerable rise. Several improvements in value were effected by various undertakings in distant parts. Both issues of Chicago bonds had a good rise; and San Paulo continued its upward movement. Melbourne bonds are also a point better *ex div.* Among the Water Companies, business was more active; and the general tendency was favourable. East London moved irregularly, owing to the uncertainty felt as to the result of the Local Government Board inquiry.

The daily operations were: The Gas Market opened rather tamely on Monday; and business was at no time very brisk. Chicago first mortgage bonds rose 2½. There was considerably more activity on Tuesday, with good steady prices. Brentford new advanced 4½; and San Paulo, ½. In Water, West Middlesex improved 3; East London, 2; Lambeth, 1; and Grand Junction, ½. On Wednesday, transactions in Gaslight "A" were the main feature; prices being very even. South Metropolitan "C" rose 5; ditto "B," 3; and Chicago second mortgage bonds, 2. East London Water relapsed 2½. Business on Thursday was more restricted; and the only alteration in quotations was an advance of 2 in Gaslight "J," with business done at 286. Friday's transactions were not remarkable; but prices seemed a shade higher. Continental Union rose 5. Saturday was quiet and firm; and quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Question of Raising the Voltage of Low-Pressure Electric Supplies.

THE topic of the hour in electric light circles is the recent decision of the St. Pancras Vestry to raise the voltage of their supply from 110 to 220—an alteration that has already been effected by the Electric Lighting Committee of the Bradford Corporation, and formed the subject of an article in an engineering contemporary which was discussed in this column at the time. The change in question has been made by the advice of Mr. Baynes, the Electrical Engineer to the Vestry, who has only recently left the service of the Bradford Corporation; so that the new policy may be held to be a point of personal practice with him. It has aroused a good deal of animated, not to say acrid, controversy in the columns of *The Times;* but the merits of the matter are not to be decided by the *dicta* of more or less interested electricians. It appears that, for the present, only new customers of the St. Pancras undertaking are to be put upon the higher voltage service; but in the long run, if the change works well, and without much delay, it must be made general in the district. The principal question arising in connection with the alteration of pressure refers to the lamps. Hitherto lamp manufacturers have been accustomed to work to the lower standard of from 100 to 110 volts; and it is admitted that an altogether new make of lamp will be needed to meet the fresh conditions of the service. Mr. Baynes declares that there is no difficulty in the matter, since he has had 220-volt lamps in use for 18 months, presumably at Bradford; and he further states that 8-candle lamps at 230 volts are in the market, and a high-voltage lamp of even 6-candle power is on offer.

Professor J. A. Fleming has given a qualified assent to the

change; but he thinks that, if the higher voltage is to become general, domestic fittings will have to be much more severely tested and inspected than has been customary heretofore. Mr. Baynes concedes the necessity of very careful inspection and testing; but he observes that this is an essential point in any well-regulated central station, and applies to any system. This is doubtless the case. But past experience has not shown that the St. Pancras installation stands particularly well in this respect; and captious critics might inquire how much more sodium the Vestry expect to make in their underground conduits under the new conditions. So far as the cardinal point of the safety of users of the new high-pressure service is concerned, it is stated that there is no more risk of getting a dangerous, or even painful, shock from a 220-volt service than there is from one carrying half the voltage; the utmost that would be felt being a tingling sensation if two terminals were connected through the skin. Time will elucidate this question. But meanwhile it is clear enough that the change to the higher voltage is all in the interest of those central station undertakings that are committed to the low-pressure principle of electric distribution. So far it is a concession to the high-pressure school, who have all along contended that no system in which the mains are restricted to carrying only the low voltage hitherto employed can be commercially successful over anything like an extensive area. It means burying a copper mine to command even such a compact district as that of the St. James's and Pall Mall Company; and, of course, to double the voltage renders this copper competent to earn much more money.

There is no reason to suppose that consumers will care whether they are supplied at 110 or 220 volts, so long as they are assured that their fittings will stand. But this is certainly not a time when they could be expected to incur any extra expense for adapting their fittings to suit a change made wholly in the interests of the suppliers. If, moreover, there is any real difficulty in procuring, at no greater cost, low-power incandescent lamps of the new pattern, the suppliers may well lose as much as they can hope to save by the new system of supply. Electricians themselves seem to hold that much depends upon the possibility of satisfying their consumers with the 8-candle lamp which has been adopted as the conventional unit for the enumeration of lamp connections. This gives but a low standard of lighting, and is confessedly inappropriate to shop and general commercial use. But domestic users are expected to be content with it; and they are not encouraged to patronize anything more brilliant. Now we hear of a 6-candle high-voltage lamp as being yet more suitable for lighting interiors. Whether or not the public will take kindly to this progressive degradation of their house illumination, remains to be seen. We may be mistaken, but imagine that a glimmering "night light" on this scale is not the most hopeful weapon wherewith to attack the incandescent gas-burner. The incandescent electric lamp trade is naturally perturbed at the advent of a change that bids fair to render all stocks valueless, and sets up a standard in lamp manufacture to which only a few factories have yet learnt to conform.

Mr. Baynes may be, and probably is, right when he says that the 110-volt lamp, like the original 50-volt lamp of Edison and Swan, is fated to become in time "a matter of ancient history." But the makers and sellers of the article so condemned are not likely to derive much consolation from this reflection. There never was much trade done in 50-volt lamps, which were proprietary goods, and more curiosities than anything else at that. But the manufacture of 100 to 110 volt lamps has attained to very large proportions; and they will not be ousted without a struggle. Still, the industrial clock cannot be made to stand still at the bidding of those who are pecuniarily interested in arresting the flight of the moment. If the new system is good for anything, and anywhere, it must infallibly spread. It was the incandescent lamp that made the electric lighting industry; but now the lamp must follow in its train. There is yet the question of fire risk, about which the insurance companies will have to say something. Dr. Fleming observes that with a three-wire system of distribution charged throughout with a difference of potential of 200 volts between each side of the system (making 400 volts over all), conditions might arise that would throw the whole pressure upon house fittings originally calculated for 100 volts only; and this is something to be carefully weighed.

Consolidation of the Brooklyn Gas Companies.—For something like a twelvemonth negotiations have been in progress for the consolidation of the seven Gas Companies in Brooklyn; and the recent filing of the certificate of incorporation of the Brooklyn Union Gas Company, with a capital of $15,000,000, is a sufficiently clear indication that they have been brought to a successful termination. The following are the names of the Companies, with the amounts of their capital: Boston Gas-light, $2,000,000; Fulton Municipal, $2,000,000; Citizens', $1,750,000; People's, $1,000,000; Williamsburgh, $1,000,000; Metropolitan, $1,000,000; Nassau, $1,250,000. The new Company hold a controlling interest in the stock of every one of them; and it is stated that they have spent nearly $12,000,000 in the purchases. It is believed that the consolidation—the chief opponent of which was Mr. J. E. Addicks—will result in a great saving of expense to the producers, in the works as well as in the offices.

THE PRESERVATION OF IRONWORK BY PAINTING.

Few subjects are of more practical interest for the engineering constructor—be he designer, contractor, or superintendent—of iron or steel structures, than the means to be employed for preserving these materials from corrosion, rusting, and decay. Time was when the principal labours of the engineer were carried out in stone or brick; but this is the age of steel and iron, and at the present time the proportion of capital laid out upon structures in the latter class of materials has attained to an unprecedented and constantly growing figure. The difference in question has many ulterior consequences, not the least striking of which is the great prominence assumed by paint. The engineer of old time, after he had successfully brought his bridge, or his pier, or whatever the structure in stone or brick might be, to complete realization, could leave it alone with confidence that it would endure for as long as it might be wanted, without further attention from him. But his modern successor knows that, without well-directed, assiduous preservative treatment from the very first handling of the materials in which he works, all his skill of design and construction will be thrown away. Men can do wonders in the way of construction with iron and steel. But these materials are perishable in every form and grade used in the arts; and this consideration imposes upon those who have to deal with them the gravest responsibility for taking such preservative measures in regard to them as will most effectually counteract their natural tendency to crumble into the dust. The modern engineer has occasion to realize to the full the lesson conveyed in the well-known lines describing the insubstantiality of those "cloud-capp'd towers" which he nevertheless has occasion to erect; and if Shakspeare had had modern constructions in steel and iron in mind when penning his gorgeous rhapsody, he could not have more succinctly described the eventuality against which the engineer has to keep incessant watch and ward.

Painting—including in the meaning of the word every description of surface treatment of a perishable material of construction, other than a purely chemical process which superficially changes its nature, with the object of preserving it from rusting and decay—is the subject of many technical papers; but the interest of the matter is not to be exhausted by any number of essays. The most pretentious recent contribution to the literature of preservative, as distinguished from decorative, paints is a paper read by Mr. M. P. Wood before the last meeting of the American Society of Mechanical Engineers, which is worth summarizing, and will also serve as a "peg" whereon to hang a few additional observations on the subject-matter. Mr. Wood states the essentials of a good paint, for whatever use intended, as follows: First, it must adhere firmly to the surface over which it is applied, and not chip or peel off. It must be non-corrosive to the material it is used to protect, as well as to itself, under long periods of atmospheric exposure and chemical changes. It must form a surface hard enough to resist frictional influences, yet elastic enough to conform to all changes of temperature, or with a coefficient of elasticity as nearly as possibly the same as that of the material covered by it. It must be impervious to, and unaffected by, moisture and atmospheric and other influences to which the structure may be exposed. Secondly, the paint must work properly during the laying on—a property depending largely upon the relative proportions of pigment and liquid; the nature of both elements having also influences upon the result. Thirdly, it must dry sufficiently rapidly; this function depending mostly on the liquid, although the pigment in many cases influences it. Fourthly, the paint must have proper durability, which is a function both of the pigment and the liquid. And as the question of cost often governs the selection of a paint, the element of durability may be regarded as the most important one in the list. It does not always follow, however, that a paint good and durable in itself has good protecting results; the nature of the surface to which it is applied (such as rusty iron) sometimes neutralizing its own virtues. Fifth comes the question of covering power, by which is meant the capacity to afford the greatest amount of protection for the least expenditure of material.

The term covering power means different things to different colour manufacturers and master painters, according to the purposes which the paint is intended to subserve. For structural purposes, the term commonly means the extent of surface that a given weight or quantity of paint will cover. Mr. Wood states that a good iron oxide paint will cover nearly twice as much surface as white or red lead. The specific gravity of the pigment enters into this question, and so does its refractive power for light, and physical condition as to grinding. Lamp-black, because of the minuteness of its particles, goes farther as a covering than any known pigment; and, according to Mr. Wood, one part of lamp-black and nine parts of sulphate of lime by weight give most excellent results in covering power. Prussian blue, the scarlets, and the pigments called "lakes," on account of their light-dispersing power, deceive the eye as to their covering value when they are freshly laid on; but they soon exhibit their worthlessness.

The designing of a paint, for whatsoever purpose intended, necessarily involves consideration of the points already set

forth, as well as the cost. The first question to be answered in connection with the preparation of a paint is, according to Mr. Wood, whether it is necessary for the pigment to be used pure, or whether an admixture of inert substances can be permitted—presumably to give body to the paint. He states, in reply to this, that experiments of long continuation lead to the conclusion that oxides of iron, lead, manganese, and other strong pigments, can be mixed with large proportions of inert substances without any detriment, and generally to the manifest improvement of the paint as a protective agent on many structures, notably of wooden or composite material. He illustrates his meaning with reference to oxide of iron paint. If one ounce of this pigment, pure, be spread in two coats over a given surface—say, of two square feet—so that the surface is completely hidden, and the job is a satisfactory one so far as covering power is concerned; and if, secondly, the same weight of oxide be mixed with three times as much barytes, kaolin, or gypsum, and the resultant compound spread over the same area of surface as before—it is obvious that the amount of colour per unit of surface will be the same in both cases; but in one case there is four times as much pigment in the paint as in the other, and three-fourths of it inert. Yet for railway cars, and wooden structures generally, preference would be given to the latter preparation, for durability as well as cheapness in the bulk.

Mr. Wood distinguishes as inert substances in a paint those which do not promote the oxidation of the oil or the substance to which the paint is applied—such as whiting, sulphate of lime, barytes, kaolin, silica, feldspar, and talc. Whiting, gypsum, and barytes he regards as the best of the list; the others being objectionable as grinding greasy, or hard to grind, or of a nature readily decomposed by water. Barytes, from its great weight, is objectionable only when bought by the pound in a dry state, or when occurring as an adulterant in paste or prepared paint. He styles sulphate of lime the best of the inert substances to mix with any pigment, all things considered. It should be thoroughly hydrated, when as much as 45 per cent. by weight can be mixed with 50 per cent. of sesquioxide of iron as a pigment. (This remark seems to apply only to artificial oxide of iron paints.) Oxide of iron he describes as practically unchangeable by centuries of exposure. At the same time, he terms it an agent for inducing and promoting oxidation in all organic substances with which it is brought in contact, which in an oxide paint is the oil. This statement only holds true when there is no chemical change or combination between the pigment and the liquid or medium.

Prizes for Essays on Profit-Sharing and Trade Unions.—M. le Comte de Chambrun has offered two prizes for essays on "Profit-Sharing" and "Trade Unions." The latest date for sending in the former is Dec. 31, 1896; but a year longer is allowed for the latter—possibly owing to the wider scope of the subject. They are to be addressed to the Société des Etudes Sociales, Paris. The Count is known to be identified with social questions; he having endowed the Social Museum in Paris.

The Liverpool Meeting of the Institution of Gas Engineers.—By an inadvertence which escaped notice during the preparation for the press of our account last week of the Liverpool meeting of the Incorporated Institution of Gas Engineers, we wrongly designated Mr. W. King the President-Elect of this organization. Mr. W. Foulis, of Glasgow, is the Vice-President of the Institution; and it is therefore to him, if to anybody, that the description applies. It was, however, merely in the ordinary colloquial sense that we used the term, which has no place in the official nomenclature of the Institution. We permit ourselves to hope, in the interests of the Institution, that, notwithstanding the strain brought upon the Engineer of the Liverpool Gas Company by the duties and responsibilities of his position in the city, which may render Mr. King loth to take any other office for the present, our mistake may turn out in time to have been rather an anticipation.

Presentations to Mr. Albert Ford.—On the completion of a three years' eventful engagement with the City of Santos (Brazil) Improvements Company, Limited, as the Engineer of their gas and water works in Santos, Mr. Albert Ford was presented by the employees with a plated toilet service, inscribed in English and Portuguese, an illuminated address, and a gold watch and chain; and on the 26th ult., the Directors placed in his hands a cheque for £50, accompanied by a testimonial of their appreciation of his work. and by expressions of regret that he was unable to continue in their service. Mr. Ford was selected out of about 200 candidates for the position he has just relinquished; and during his tenure of it he had a trying experience. For six months there prevailed a "labour famine;" there were two epidemics of yellow fever and one of small-pox; and, to crown all, there was the revolution. Notwithstanding these impediments, Mr. Ford has remodelled the gas-works, reorganized the water-meter system, and constructed a masonry service reservoir capable of holding a million gallons. His average make of gas in 1894 was 11,190 cubic feet per ton of coal; the illuminating power being 18·2 candles, using 13 per cent. of cannel. In that year the net receipts were 43 per cent. more than in 1893. During the three years, 300 new gas services and 1200 new water services were connected and 200 new lamps were put up.

NOTES.

Purifying Gas Without Valves.

In connection with the recent visit of the members of the Incorporated Institution of Gas Engineers to the Garston works of the Liverpool Gas Company, it should be recorded that the attention of the visitors was drawn by the Engineer of the Company, Mr. W. King, to a peculiarity of the purifying arrangements. The carburetted water gas made at these works—as described in last week's JOURNAL—is purified by lime, with a catch purifier of oxide. The singularity of the arrangement of the purifying plant consists in the absence of valves; their place being supplied by simple syphons or U bends in the gas-mains, which can be filled with water so as to absolutely cut off the passage of gas, or emptied at will. It was explained by Mr. King that he had had so much trouble with valves in connection with sulphur purification—even those of the water-slide type—that, when it became necessary to provide purifying arrangements for the new carburetted water-gas station, he decided to dispense with everything of the kind, and fall back upon the simple, positive action of a syphon. There can at any rate be no leakage of gas through such a substitute for the usual valve; and the only obvious drawback—the liability to freezing during severe weather—can, of course, be met in the ordinary way already employed in the same circumstances for the hydraulic seal of the purifier covers. It is believed that the Garston purifier house is unique in regard to the absence of valves of any kind.

The Water Supply of American Lake Cities.

In view of the project of the London County Council for rejecting the River Thames as a source of water supply for the Metropolis on account of its liability to sewage contamination in the upper parts of the stream, it is interesting to note that the New England Water-Works Association have just held their annual convention in the city of Burlington, Vermont, which shares with Chicago, Milwaukee, and many other centres of population in the North American lake region in the practice of taking its water supply from the same lake into which its sewage is emptied. Professor W. T. Sedgwick, of the Massachusetts Institute of Technology, lectured to the members upon the bacteriological features of the situation thus created. He explained the results of the thorough study of the entire sanitary problem which he was instructed by the Water Board of Burlington to make in 1892. He found, greatly to his surprise, that the vital statistics of the city showed it to have been remarkably free for many years from typhoid and other diseases attributable to polluted drinking water; comparing in this respect very favourably with many cities having wholly unpolluted drinking water. This happy result appeared to be due to the configuration of the lake at the points of sewage discharge and water intake; the former being so situated that the sewage had time to settle or get purified and the germs of possible disease to die, "or otherwise disappear," before entering the lake proper. Nevertheless, the growth of the city necessitated the removal of the water intake (previously less than a mile from the sewer basin) to a distance of three miles from the sewer outfall; and since this has been done, the bacterial tests show that all fear of contamination of the water supply by the sewage has for the present been removed. The people of Burlington evidently have no pedantic aspirations for an ideally uncontaminated water supply.

Preventing the Electrolysis of Cast-Iron Mains.

The general subject of the electrolysis of gas and water mains by currents employed for traction has been investigated by Professor Storrs, of the University of Vermont. He observes that to prevent the electric current returning by the pipes, these must be made not readily available paths for it. This work must begin with the electric railway itself. If the rails are properly bonded from end to end of the track, and the track connected to the negative side of the generator by a wire of proper conductivity, a very large part of the electricity used by the car-motors will avail itself of this easy path back to the generator. If this means proves insufficient, then additional paths must be provided in the shape of some large copper wires called "return feeders." Yet sometimes, in spite of this precaution, the current will jump from the rails through the earth to the pipe. In such cases, direct metallic connection of the rail to the main should never be permitted; but where the rail is found to be electro-positive to a neighbouring main, so that the latter is exposed to the electrolytic action, a special return wire is provided connecting the pipe itself back to the generator. This device appears to be effectual, according to Professor Storrs. It was not long ago, however, that another authority declared the evil of electrolysis to be incurable.

Testing Cement by Specific Gravity.

In a recent article describing certain French appliances for determining the specific gravity of Portland cements, the *Engineer* observes that, within the last few years, this method of testing cements has "passed out of the category of methods of assay to be occasionally used into that of modes of testing habitually employed in the evaluation of this class of constructional material." The change has been brought about by the increased fineness to which cements are now ground, which has

altogether upset the old-fashioned requirement of so much weight per bushel. Consumers were not slow to perceive that the more finely ground, and consequently the more perfectly prepared, cements must necessarily weigh less per bushel, other things being equal, than those which are coarser and therefore less efficient. It has also been found impossible to formulate a satisfactory sliding-scale, with the object of creating a standard of relation between fineness and weight per bushel. At this juncture, appreciation of the fact that the specific gravity of a cement is unaffected by the degree of fineness to which it has been ground led to a general disparagement of the old standard of weight per bushel, and to the adoption of the determination of specific gravity in its place. It is now accepted that the specific gravity of a cement will give all the information respecting its quality which was derivable from the older method of taking the weight per bushel, besides indicating some points not derivable from other methods of testing. With regard to the degree of accuracy with which the specific gravity of a cement must be determined in order to yield useful results, it may be stated that very roughly approximate figures will suffice to relegate a product, of which the origin and history are unknown, into its proper class. Thus a specific gravity of about 3·15 at once stamps the article as true Portland cement. With ordinary skill and care, the specific gravity of a cement can be determined to 0·005, which is amply sufficient to detect slag sophistication and underburning.

Water-Meters on Hire.—The system of hiring out water-meters has come into regular practice in New South Wales. The number in use is now 5082.

The Action of Light on Dyed Colours.—At the recent meeting of the British Association, the Committee appointed some time ago to investigate the subject of the action of light upon dyed colours presented the report of their proceedings during the year 1894-5. The previous investigations of the Committee have been already noticed in the JOURNAL. Certain groups of colouring matters which could not be included in the Committee's earlier experiments have now been examined, as well as some additional coal-tar colouring matters recently introduced. The results of the exposure experiments are tabulated in an appendix to the report; the colours being divided, according to their behaviour towards light, into five classes—very fugitive, fugitive, moderately fast, fast, and very fast. These are again divided into other chemical groups. With respect to the popular notion that, generally speaking, coal-tar dyes are fugitive, it is found that, while there are some fast and some fugitive colours from natural sources, it is possible to select a larger number of fast colours from coal tar than can so far be obtained from natural sources.

Golden Wedding of Mr. and Mrs. Thomas Clapham.—On Monday, the 23rd ult., Mr. and Mrs. Thomas Clapham, of Aireville, Keighley, were the recipients of the very cordial congratulations of their numerous friends on reaching the fiftieth anniversary of their wedding-day. These felicitations will, we are sure, be joined in by many of our readers, for the name is well known in the gas profession. Mr. Thomas Clapham is one of four brothers, two of whom were associated with him some years ago in establishing the business which has developed into the extensive undertaking carried on under the style of Clapham Bros., Limited. Though a septuagenarian, Mr. Clapham possesses remarkable vigour. Mrs. Clapham's health, however, is less robust; and on this account the festivities on the above-named occasion were of a quiet nature. But the good wishes expressed on all sides were none the less hearty; and to them we have much pleasure in adding our own. In looking back over their half-century of wedded life, it must be a cause of thankfulness to both Mr. and Mrs. Clapham that not one of those many years was saddened by death in their family.

High Masonry Dams.—This subject was discussed in a paper presented by Mr. J. D. van Buren to the American Society of Civil Engineers, and published in the Society's *Bulletin*. The author is of opinion that five different conditions of safety are to be considered in relation to masonry dams—viz., (1) against overturning; (2) against sliding; (3) against crushing near the toe; (4) against ice and waves; (5) against undermining. After the engineer has fixed upon these conditions of stability or safety, which express his scientific and practical judgment, the design of the section is easily made by the aid of simple mathematical formulæ. In addition to the usual forces assumed to act on a dam, the author considers water pressure on the base under full head. This force is usually ignored in designing the section, under the supposition that the masonry can be either made practically water-tight or drained in such a way as to relieve this pressure. The author thinks nothing practical is gained by considering any other section than the triangle, which is the true shape at all levels for stability against overturning and sliding. The following five assumptions are made by him as the basis of his mathematical dissertation: (1) That there shall be a full water pressure on the base at all levels; (2) that the ground pressure shall be a uniformly varying force; (3) that the coefficient of friction shall be known; (4) that the pressure at the toe shall not exceed a certain amount per square foot; (5) that there will be a known ice pressure per linear foot of dam at the crest.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Hexham.

The Thirty-Sixth Half-Yearly Meeting of the North of England Gas Managers' Association was held on Saturday, at Hexham, where the President for the year—Mr. HERBERT LEES—is stationed. The company assembled at the works of the Hexham Gas Company at eleven o'clock, where they were met by Dr. Thos. Stainthorpe, the Chairman of the Directors of the Company, Mr. W. R. Riddle, and Mr. Dixon Pratt, both Directors of the Company. Mr. Lees conducted the visitors over the works, which have been almost entirely rebuilt during the past fifteen years, and are now particularly well housed. Though the site is a small one, the arrangement of the buildings is such that the most has been made of the ground. The system of retort-firing is regenerative. The Gas Company have all along followed a liberal policy towards their consumers, in the matter of discounts and otherwise. Their reward is seen in the fact that, whereas in 1872 the make of gas was about 4 million cubic feet, it is now about 25 millions per annum, and that, too, although the population of the place has not increased; and also in the fact that they have a ready sale for all their bye-products—the coke-heap being small, and there being no tar in evidence.

VISIT TO THE ABBEY.

After inspecting the gas-works and partaking of light refreshments which were provided by the President, the party walked to Hexham Abbey, a venerable ecclesiastical building in great part in a wonderful state of preservation, and presenting some fine architectural features. A very interesting historic account of the Abbey was given by Mr. Robert Robson, the custodier.

THE MEETING.

The party were then driven to the Tynedale Hydropathic Mansion, a fine building in beautiful surroundings, where the meeting was held. There was a large attendance of members.

The PRESIDENT expressed the regret of his Chairman at not being able to be present at this portion of the proceedings. Many of them saw him at the works, and they would see him again; but he was a busy man, and had many duties to attend to. The Chairman, however, gave them a very hearty welcome, and asked him to say so for him. He did the same himself. It gave him great pleasure to see so many of the members there; and he hoped they would have a very successful meeting. He had letters from Mr. W. R. Chester, the President of the Incorporated Gas Institute, regretting his inability to be present; and also from Mr. R. Wallis, J.P., of South Shields, who, on account of advanced years, felt compelled to stay away.

NEW MEMBERS.

The following new members were admitted, on the recommendation of the Committee: Mr. T. Settle, Manager of the Gas-Works, Knaresborough; and Mr. C. B. Newton, Engineer and Manager of the Gas and Water Works, Carlisle.

PROPOSED REVISION OF THE RULES.

The PRESIDENT said that, since their last meeting, the question of the revision of the rules of the Association had been before the Committee; and it was necessary that notice should be given before this could be done. He, therefore, gave notice that, at the next meeting, something should be done as to the revision of the rules.

THE PRESIDENT'S ADDRESS.

The PRESIDENT delivered the following

INAUGURAL ADDRESS.

Gentlemen,—The position to which you elected me at your last annual meeting is one which I should be unworthy to occupy if in any degree I was lacking in appreciation of the honour conferred upon me. I again thank you for the confidence you then reposed in me; and if the Association should in any sense suffer by the selection you have made, I can assure you that it will not be for want of effort, so much as of ability, on my part to maintain the prestige to which it has now attained. I am deeply sensible of the responsibility attaching to the office; and when I look back upon the long line of my predecessors, many of them men of eminent ability, you will not be surprised if at times I have had "misgivings." I know, however, that I can rely upon the sympathy and support of the general body of members, who have always proved their loyalty to those gentlemen they have elected to this and other official positions.

As one of the younger members of the Association, I should like to urge those of my own class to take a more practical interest in its affairs. This is a matter which ought to need no pressing. Within recent years, many have joined our ranks who are capable of increasing the usefulness of the Association; and I hope that during my year of office some of this latent talent will be developed, either by contributing papers or in discussion. Let it not be inferred from these remarks that it is thought that all the wisdom and experience is "bottled up" in the youth of the profession. We should greatly regret—and it

would be an irreparable loss—if the men of ripe experience should abate their interest one whit, or in any sense relax their efforts to advance the objects of the Association. It is not necessary that one should give place to the other, but rather that the younger members should emulate their seniors, and they in turn lead us on to greater triumphs than have yet been accomplished, and thus still further enhance our position among kindred societies.

The duty which more particularly devolves upon me at this point—namely, that of placing before you material for thought and consideration on questions of a technical or administrative character relating to the manufacture and distribution of coal gas—is one that does not get easier as the years revolve. We are so well supplied with technical journals, that nothing of interest to the gas engineering profession is allowed to escape notice therein; and so many presidential addresses and other communications are written every year, that it seems next to impossible to advance a new idea, or clothe an old one in new language. I am not in the fortunate position of being able to unfold to you the details of some new invention which is destined to revolutionize the gas industry, and make the electric light sink into pale insignificance before the brilliancy of our future prospects; nor am I pessimistic enough to suggest to you the extreme course of making serious preparation for adopting some other means of obtaining a livelihood. I hope, however, that I shall, before closing my remarks, be able to give some tangible evidence of the advance that has been made, and of the reasonable expectations to which we may look forward.

It will perhaps not be out of place if some reference should be made by me to the undertaking with which I am connected, and the works you have had an opportunity of seeing to-day. The history of the gas supply of Hexham dates back for a period of over sixty years; and during that time, the undertaking has passed through many vicissitudes. It is, however, many years since it was established on a sound basis. From that period, its record has been one of steady progress; and it now occupies a prominent position among the smaller gas companies of the North of England as a means of investment. This result has been achieved not by methods which are foreign to other gas companies, but by the application of those principles which contribute very largely to all successful undertakings of a similar character.

At a comparatively early date, the question of utilizing gas for purposes other than lighting was prominently brought before the consumers, by means of an exhibition of gas appliances; and from time to time this has been supplemented by smaller exhibitions and cookery lectures, and a free use of the literature so familiar to all of you. The result is that during the past eleven years—without any increase in the population of the town—the gas consumption has grown to the extent of 80 per cent.

The number of appliances in use for purposes other than lighting is as follows: Cookers, 132; grillers, boiling-rings, &c., 129; gas-fires and heating-stoves, 91; gas-engines, 9—making a total of 361. The total number of consumers is 866.

In addition to the development shown by these figures, there has been a decided improvement in the illumination of shops and private houses, although there is room for further advancement. In some cases, this has been brought about at a reduced cost. I wish it were possible to record a corresponding advance in the public lighting of the town. The increased consumption referred to will seem more important when I tell you that for the previous twelve years there was a growth of 196 per cent., making a total increase in 23 years of 433 per cent.

Rather more than two years ago a further advance was made, when the "penny-in-the-slot" system of supplying gas was introduced; and although we have not been able to obtain so large a consumption per consumer as is reported from some towns, the system has fully justified its adoption. As from the first we have supplied the fittings and a griller—and in some cases a small cooker—it has also become an advertising medium for cooking by means of gas.

It is not possible for us to do too much in the way of advertising, and of educating our consumers; only our advertising should be judicious and persistent. I have no novel method to offer you. My plan is to keep in touch with the consumers as much as possible, and see that they are well supplied with literature; and if some of this should find its way into the waste paper basket, not to be discouraged, but send more.

I am of opinion that we ought, not only as individuals, but as an Association, to do more in the way of arranging popular lectures on methods of illumination and other means of utilizing gas. As an Association, we have done nothing in this matter outside the limits of our ordinary meetings; but is it not possible to arrange for a series of lectures to be given in various towns during the winter months? While it would be impossible for many of us to prepare a course of lectures in addition to the worry and strain of a winter's work, it might not be too much to take up one phase of the question; and by arrangement, interchanges could be made, so as to give a full course in a given town. If such a scheme could be adopted, I believe it would receive the sympathy and support of the proprietors of gas undertakings, and could not fail to be beneficial in its results. It would be fallacious to suppose that all this would tend to "bring grist to the mill," unless the internal administration of the concern was of a popular character. We want, as far as possible, to remove those "relics" of a bygone age which, under the guise of safeguards, are really obstacles to the development of business.

If it should be necessary to adopt or retain the "deposit" system at all, let it be *only* as a safeguard, and not be applied all round as a mere matter of red-tapeism. Then there is the question of initial charges before a person can become a consumer. It has been the custom here for a good many years for the Company to bear all charges for service-pipes and meter fixing, unless under very exceptional circumstances as to distance. This I believe to be of far more importance than the abolition of meter-rents; and yet there are some who concur in the payment of at least a certain portion of these outlays, and at the same time talk of the system of charging meter-rents as unjust and injurious to the development of consumption.

This question of meter-rents has been invested with an importance far beyond its merits. It has served many an embryo town councillor with an election cry; and if we could trace its origin, it would probably be found to have made its *début* on some platform at a ward meeting, during one of those annual campaigns which take place in our boroughs about the end of October. It has, however, passed beyond this stage; and now that the largest gas company in the world has included it in its policy, others will no doubt be not less slow to adopt it in consequence. I am bound to say that, in my experience, I have never found the meter-rent to be an obstacle to the growth of gas consumption; but I have frequently met with complaints of charges for fixing meters. But how would the change affect our consumers? We know that it would make little or no difference to the shareholders. If meter-rents are abolished, the price of gas will be maintained to give the equivalent. The result will be that one consumer will be benefited at the expense of another. The following table will show how the question would apply to Hexham:—

TABLE I.—*Ratio of Meter-Rents to the Consumption of Gas at Hexham.*

Consumption per Annum.	No. of Consumers.	Total Consumption per Annum.	Average Consumption per Annum.	Total Meter-Rents.	Meter-Rents per 1000 Cub. Ft.
Cubic Feet.		Cub. Ft.	Cub. Ft.	£ s. d.	d.
5,000 and under	146	373,200	2,555	15 19 4	10·27
Above 5,000 and below 10,000	123	814,800	6,624	15 3 9	4·47
,, 10,000 ,, 25,000	182	2,866,600	15,750	25 0 0	2·09
,, 25,000 ,, 50,000	65	2,236,700	34,411	10 12 0	1·13
,, 50,000	72	6,845,900	95,082	19 4 6	0·67
Consumers using own meters	133	6,958,800	52,322	..	..
	721*	20,095,800	27,872	85 19 7	0 91

* Prepayment consumers not included.

It will be seen by a glance at this table, that the 146 consumers who are the least lucrative under present circumstances would receive a most abnormal concession—equivalent to a reduction of 10¼d. per 1000 cubic feet—if meter-rents were abolished; while the 72 consumers of 50,000 cubic feet per annum and upwards, and the 133 who provide their own meters, and who are the mainstay of the Company's consumption, would have to pay at a higher rate to meet this. This is contrary to the accepted principles upon which business is conducted.

These small consumers are not by any means confined to the working class, but are largely composed of tenants of offices and small lock-up shops, where it is convenient to have gas in readiness, and where, unfortunately for us, it is seldom used. The abolition of meter-rents would mean the removal of many of these consumers from our books; otherwise they would be retained at a distinct loss. I am afraid the subject has not received the careful consideration it deserves; and where public opinion may have appeared to influence abolition, surely it is for want of accurate knowledge, and that we ought to be in a position to supply, as it affects our respective districts.

What is of far greater importance as influencing the consumption of gas than the question of meter-rents, is the price at which we can sell. There will always be some difference of opinion between the buyers and the seller as to what is a reasonable figure; hence none are entirely free from complaints on this head. The smaller companies probably suffer most in this respect, doubtless because comparisons are made with the larger undertakings, the circumstances of which are widely different.

Whatever conduces to economy of manufacture or distribution of gas should receive the consideration of those responsible for such undertakings. Like other industries, we are to a certain extent subject to fluctuations in the price of raw materials; and we are also affected by the sale of residual products at our disposal. These are influences over which we have no control. Economies of manufacture naturally begin in the retort-house. It has been said that profits are made or lost there; but it would be unwise to assume that it is the only place where profits are made or lost, and hence the necessity for giving the most careful attention to every detail up to the point of consumption—not forgetting the small savings, which in the end prove very important.

Some of you may perhaps remember a leading article which

appeared in the JOURNAL OF GAS LIGHTING about eight years ago, under the heading "A Drop of Solder." This article is stated to have been suggested to the writer by the story of an American workman having invented a method of wiping off the spare drop of solder, which previously had been allowed to remain on the tins made for use in preserving fruits, &c. It was a little thing; but it produced marvellous results. The moral is obvious. But we might do worse than re-read that article occasionally; and if we could also get its principles firmly impressed upon every workman and member of the staff, the gas industry would be the richer for it.

We have endeavoured to do something to reduce the cost of manufacture here. Rather more than two years ago, we introduced the system of gaseous firing to the retorts, and last year made a further extension in the same direction, so that all the retorts are now heated by means of generator furnaces, with very satisfactory results. Coke sales have increased to the extent of about 2½ cwt. per ton of coal carbonized, equivalent to a saving of at least 1s. 3d. per ton of coal; while the cost of carrying out the necessary alterations did not exceed £250. The erection of a coal-store has conduced to greater safety and more comfortable working—factors upon which it is difficult to fix a money value; but they possess one, and something more. The cost of purification is kept within very reasonable limits, by an adequate provision of purifying space and a good sale for spent lime. The adoption of the "air process" has not been entirely overlooked. Some experiments have been conducted; but the results have not yet proved satisfactory, although I have reason to believe that, when the initial difficulties—probably due to local circumstances—have been overcome, we shall be able to carry on purification with still greater economy, and with less nuisance from the spent lime.

Placed as we are in the centre of an agricultural district, it was natural that we should turn our attention to the manufacture of sulphate of ammonia. This has proved a right step, even at the low prices that have ruled during the past season. It is somewhat surprising that farmers do not use sulphate of ammonia to a greater extent than is done at present, especially so at the prices at which it has been sold this year. Its more extended use would probably do more towards relieving agricultural depression than either bimetallism, protection, or a good many more of the remedies the State is asked to apply, in order to spare ndividual effort. A series of experiments carried out under the direction of Professor Somerville (the details of which are given in a report to the County Councils of Northumberland and Durham) go to prove that sulphate of ammonia and nitr ate of soda are about equal in value per unit of nitrogen —*i.e.*, 8 6 lbs. of sulphate of ammonia is as effective as a fertilizer as 112 lbs. of nitrate of soda. In certain seasons, sulphate produced the best results; while in others, nitrate had the advant age. Therefore, when nitrate of soda was quoted at £8 5s. per ton, sulphate of ammonia possessed a value of £10 1 5s.; and yet at that time the latter was selling at £9 5s. per ton, and in some cases even less. We can only hope that, as the knowledge of these facts becomes more widely disseminated among the farmers than it appears to be at present, we shall to some extent share the benefit.

It is important that occasionally we should, in a general way, review the work of past years, mark the progress that has been made, and ascertain where it is possible to strengthen our position for the future. I have endeavoured to do a little in this direction by a study of the published statistics relating to some of the principal gas undertakings in England, whose accounts are analyzed annually by Mr. Field; for progress that does not show itself on our balance-sheets is not of a very satisfactory character. The advance made in economical working by these undertakings during the past ten years (the period taken) is not so great as some might expect; but it must not be forgotten that the nearer we approach to perfection in any system, the slower will be the progress.

In manufacture, some of the factors that have been prominent are gaseous firing, labour-saving machinery, and enrichment by means of oil, tar, and similar liquids. With regard to gaseous firing, it must be remembered that the comparative progress made in individual works must necessarily depend upon the results previously obtained with the open furnace; and these have varied considerably in different works. It is not my intention to make comparisons between one individual works and another, but rather to show the relative positions of the works under consideration in 1884 and 1894 respectively.

The following table shows the quantity of coke sold per ton of coal carbonized for the years 1884 and 1894 respectively in the various groups of undertakings dealt with in Field's "Analysis."

TABLE II.—*Coke Sold per Ton of Coal Carbonized in* 1884 *and* 1894 (*Field*).

	1884.	1894.	
	Cwt.	Cwt.	Cwt.
Metropolitan Companies	9·16	9·47	Inc. 0·31
Suburban Companies	9·25	9·62	,, 0·37
Provincial Corporations	8·27	8·29	,, 0·02
Provincial Companies	8·39	8·31	Dec. 0·08

The improvement shown in the Metropolitan Companies' accounts is about ⅓ cwt. per ton of coal carbonized; and though this may seem small, it amounts to a saving of nearly 60,000 tons of coke per annum, which has a monetary value of about £35,000. The most striking feature of this table is the wide difference between the results obtained in and about London and those in the Provinces. There may be some other explanation; but on the surface it is suggestive of the need for a further extension of gaseous firing. Possibly one disturbing element is the larger proportion of cannel used by the provincial undertakings, some of which has a very low yield of coke per ton.

Other advantages claimed for gaseous firing, are the increased life-time of the retorts, and improved yield of gas per ton of coal. The latter, of course, assumes that under the old system low heats have been the rule. In the undertakings referred to in Table II., there has not, however, been on the whole any improvement in the yield per ton; and this would suggest that, under the present system of carbonization, we have approached the maximum results. I am, of course, dealing with averages, which infers that some are higher than others; and it should be our aim to reach the highest results. Till we have accomplished this—making a justifiable allowance for different classes of coal—we have not exhausted the resources of present-day systems.

The extended use of labour-saving machinery—and under this heading I would include inclined retorts—has been concurrent with an advance in carbonizing wages; and in some degree it has been adopted as the outcome of, and a safeguard against further, labour troubles. The advance in wages has either been greater than the economies derived by the introduction of machinery, or a very small proportion of the coal carbonized has been dealt with in this way; and consequently the carbonizing expenditure has been on the upward grade. The stoker has within recent years had a very good "innings." But there will necessarily be a limit to the growth of expenditure in the matter of increased wages; and as it will doubtless be found that he is paid for his work as well as, if not better than, any other unskilled labourer, we may expect that a reasonable view will be taken of the position.

It cannot truly be said that the proprietors of gas undertakings generally have not looked after the welfare of their employees. They have seen their duty in this matter, and have done it, not grudgingly, but even generously in a large number of cases. Further claims for advance where anything like the maximum rates are being paid would, in all probability, bring about a more extended use of labour-saving plant; and therefore the stoker would not be the gainer. As a rule, these labour difficulties are not seriously felt in small works; but that, of course, is no reason why justice should not be shown all round.

I am not able to speak from experience as to what extent stoking machinery and inclined retorts may have been an advantage; but there is no evidence in the published accounts referred to to show that the system has as yet had any material influence upon the cost of manufacture. There may be solitary cases where it has; but a perusal of the statistics will show that it is not general.

The enrichment of coal gas by means of oil, tar, benzol, &c., has received considerable attention within recent years. We are not limited to one particular process. Many are now on the market; but perhaps the one known as the "Peebles Process" has so far met with the greater favour. Others will no doubt claim the further attention of gas engineers; and their respective merits will be settled by experience.

I do not think we have yet made the most of our own product, tar, for enriching purposes. It is a substance perhaps not so easily dealt with as oil; and possibly this may have something to do with our comparative neglect of it. But the difficulties are not insurmountable; and when they have been fully met, we shall have in our possession another weapon that will be useful, not only for its enriching purposes, but as an aid, to some extent, in controlling the prices of that once valuable commodity.

Benzol enrichment was ably dealt with by my predecessor in the chair (Colonel Sadler) at our last meeting; and experiments were shown as to its value and ready adaptability. The one difficulty of Colonel Sadler's method of applying benzol which was suggested to my mind, is that of controlling the requisite amount of enrichment. It does not seem to me that this can be done satisfactorily by means of a bye-passing arrangement as described to us. This, however, is a minor difficulty—if it is one at all; and the ingenuity of the profession is, we trust, not so far exhausted as to be overcome by it. It was my intention to make some experiments on a small scale during the summer; but a good many other duties, which of necessity had to be performed, prevented my doing so. Benzol has been used on a fairly large scale in one or two works, and I believe with considerable success; but as yet I am not aware that any definite figures as to cost have been published.

This question of enrichment is one that does not apply largely to undertakings supplying gas of 16-candle power or under; but even in these cases, it is a question worth considering as to the possibility of using an inferior and cheaper class of coal, and improving the quality of the gas by means of liquid enrichers. With such a choice of enriching materials, we should be safe against any abnormal advance in the cost.

An important point in regard to these enriching processes was clearly shown during the very severe weather of last winter

Where the processes were in use, an entire absence of naphthalene deposits was experienced. Who would not have been glad to turn on the oil process during that period, to have given relief to suffering consumers? Some such silent and effective remedy would be very useful also when troublesome deposits of naphthalene assert themselves on the works. There are few of us who could not relate experiences of anxious moments over this "insidious foe;" and you will all agree that it is pleasanter to talk of the event when it is over, than to be engaged in the conflict with such a treacherous opponent. Any process which possesses the advantage of subduing the naphthalene trouble, will be looked upon with more favour in consequence.

There has been a satisfactory reduction in the proportionate amount of capital employed within recent years, and a very marked advance in the price of gas shares and stocks. In a recent issue of shares, the prices realized were such as to give rather less than 4 per cent. per annum on the investment; and in at least one more instance, a fraction over this amount was the result. These are factors which have an important bearing upon the general results of a gas undertaking, and may certainly be taken as signs of prosperity and confidence.

When we come to the question of methods of illumination, and the prospects of gas for other purposes, we have every reason for congratulation. It is not many years since the standard Argand burner was accepted as the one which gave the best lighting result; but since then it has given place to the regenerative lamp, and this in turn has been surpassed by the incandescent burner, which gives a lighting power of about six times that of the standard Argand. When consumers begin to realize the possibilities of gas lighting, and members of all local authorities learn that it is their duty to give the ratepayers that system of public lighting which is the most economical and effective when properly applied, the progress will be still greater. With such weapons as the incandescent and other burners now on the market, we have nothing to fear from the electrician; and, on the other hand, we should be able to meet our more modest—if not more powerful—rival, the oil-lamp by means of the "penny-in-the-slot" meter.

We have reason to believe there is a great future for the supply of gas for heating purposes. Professor Lewes informed his audience, at the meeting of The Gas Institute in Edinburgh, last June, that gas-heating stoves were made on the Continent which gave a heating result greatly in advance of anything we have in general use in this country. We may be sure that we shall not long be behind in this matter; and when we are in a position to supply a gas fire or stove that will be as economical as a coal-fire when in constant use, there is a very wide field for further developing the consumption of gas. The demand for gas as a motive power is still on the increase; and this is a field in which electric lighting and gas engineers may find mutual ground to meet upon—probably to the advantage of both. The gas-engine has made great strides; and there are still further possibilities before it.

The parliamentary returns of statutory gas undertakings in the United Kingdom show that during the past ten years the aggregate consumption of gas has increased no less than 45 per cent. This is a result which cannot be other than satisfactory to us; and, with the advantages we now possess, we should be able to maintain an equally good rate of progress. In order to still further this, let us emulate each other in our efforts to produce the best possible results. The value of our meetings will be in proportion to the general improvement shown as the result of our deliberations. It should be the ambition of each one, not to be satisfied with attaining the average standard of efficiency, but to aim at the "high-water mark" of gas-works management. I believe this ambition does exist very largely among the members of this Association; and while it is so, there is also a willingness to impart to each other any information that is likely to be of mutual benefit. Consequently, the industry at large is the better for such opportunities as are given by meetings of this character.

Mr. Holliday's Paper.

Mr. J. Holliday (Scarborough) read the following paper:—

On the Encouragement of the Small Consumer.

That there is a wide zone into which practically no advance has yet been made by gas for illuminating or any other purposes, is well known to every person who takes an interest in present day gas supply; and many of the responsible heads of various gas undertakings throughout the country have each some pet scheme whereby this unproductive area has to be caused to fructify.

One of the questions of the day, as it has indeed been more or less a question for years, is the danger of the oil-lamp. With the number of deaths resulting from accidents with mineral-oil lamps—reaching in London alone nine in one week—there is little wonder that matters have arrived at an acute stage; and whatever may result from the deliberations of the Commission promised by the Home Secretary, to investigate the causes and suggest remedies, either in the way of a more perfect method of construction of the lamp itself, or by a regulation as to the quality and "flash" point of the oil, it appears to me that we members of the gas industry have an exceptional opportunity at the present juncture. My own view is that, whatever improvements may be effected in oil-lamps, the source of danger itself will always be present. As the writer of a leading article in one of our trade journals succinctly put it recently: "The manufacture of small arms has been perfected and carried to such a pitch as to be almost a fine art; but when they are loaded they are as dangerous as ever they were, and so will 'loaded' safety lamps be."

The matter being so prominently before the public, it occurred to me, when asked by our President to read a paper at this meeting, that it might possibly be of interest if I laid before you briefly a sketch of a twelvemonth's actual returns from two systems we have in vogue in Scarborough for reaching occupiers of small cottage property who are almost by heredity oil-burners.

Some five or six years ago, a system of short accounts was introduced among small consumers; and, as far as it goes, it has answered extremely well, as may be judged from the following figures taken out for the twelve months ending June 30, 1895:—

Number of monthly consumers	271
Total consumption per annum by above . .	3¾ million cubic feet (approx.)
Average consumption per meter, about . .	13,000 cubic feet per annum.
Bad debts on a total rental of £499 0s. 1d. were	£4 2s. 6d.

= 0·39d. per 1000 cubic feet sold, or somewhat under 1 per cent. in the aggregate.

With regard to the details and conditions under which we work this system, I may explain that our gross price for gas being 3s. per 1000 cubic feet, with a rebate of 3d. per 1000 cubic feet for prompt payment, we supply our monthly consumers at the net price—*i.e.*, 2s. 9d. per 1000 cubic feet—without deposit or other security; the only condition being that the account is paid on presentation by the collector, or within three days therefrom at latest. Failing this the gas supply is discontinued without further notice. No outlay is incurred beyond that of providing and fixing a meter and main-tap.

This system works extremely well, and is a safe source of income in cases where the tenants are provided with house-pipes and the necessary fittings, or are prepared to purchase them. But in the case of houses unprovided with fittings, it of course fails to meet the necessities of the situation. Recognizing this fact, my Directors about eighteen months ago authorized me to fit up a few installations of prepayment meters, with a view to testing the possibilities of the system in Scarborough; and it is of a few of the results and experiences gained during this period that I will now speak.

The first condition imposed was that the applicant's house should not contain more than six rooms, and that the service and house pipes should be laid in. With regard to the latter qualification, however, we have found it much safer and more satisfactory to ignore it generally. As a matter of fact, in almost all the first cases we had to deal with, the pipes were found to be in a very unsatisfactory condition—leaking either from bad joints or from nail punctures. We have therefore in most cases relaid the house connections entirely from the outlet of the meter. The slight extra cost of the piping and labour certainly repays us, through having a perfect and satisfactory job to commence with. The form to be signed is of the usual type—the applicant, of course, signing the declaration as to liability for the return of the various articles in good condition, over a sixpenny stamp. It was decided to supply 22½ cubic feet of gas for each penny; and to provide each consumer with a meter, one good slide pendant, one bracket (fitted with governor burners), and at option a small breakfast griller or a boiling burner.

We have at the present time between 350 and 360 prepayment meters in action; and out of these I have taken the first seventy which had completed not less than one full twelvemonth's working upon which to base my observations. In the return relating to these seventy meters, the first matter of significance is the great fluctuation of consumption per meter—varying from a minimum of 1700 cubic feet to a maximum of 23,000 cubic feet per annum. In this respect the following table may be of interest to you:—

2	consumers	between	1,700	and	2,000	cubic feet	per annum.
3	,,	,,	2,000	,,	3,000	,,	,,
2	,,	,,	3,000	,,	4,000	,,	,,
5	,,	,,	4,000	,,	5,000	,,	,,
6	,,	,,	5,000	,,	6,000	,,	,,
6	,,	,,	6,000	,,	7,000	,,	,,
11	,,	,,	7,000	,,	8,000	,,	,,
13	,,	,,	8,000	,,	9,000	,,	,,
5	,,	,,	9,000	,,	10,000	,,	,,
7	,,	,,	10,000	,,	11,000	,,	,,
2	,,	,,	11,000	,,	12,000	,,	,,
2	,,	,,	12,000	,,	13,000	,,	,,
2	,,	,,	13,000	,,	14,000	,,	,,
2	,,	,,	14,000	,,	15,000	,,	,,
1	,,	,,	15,000	,,	23,000	,,	,,
1	,,	,,	23,000	,,	24,000	,,	,,

The mean average consumption per meter is equal to 8187 cubic feet per annum—a low figure compared with the returns reported by some other companies.

As I said before, we allow 22½ cubic feet for each penny; and as every installation costs us, on an average, £3 to £3 5s., even this consumption leaves us with just a fair margin of return for the purpose of covering wear and tear on fittings.

With regard to the consumption per meter per month, the return is most favourable, as the same level is maintained fairly

well from January to December, with the exception of March and April. This is shown by the following table :—

	Cub. Feet.		Cub. Feet.		Cub. Feet.
January . .	662	May . . .	507	September. .	685
February . .	601	June . . .	591	October . .	841
March . . .	474	July. . . .	731	November . .	934
April . . .	452	August . . .	834	December . .	875

Giving an average of 682 cubic feet per meter per month.

With regard to the meters themselves, my own opinion is that, though considerable advances have been made even during the past two years, we cannot call the system an absolute success until rather more reliance can be placed on the coin attachment not going either faster or slower than the meter index. At one of our recent monthly collections, there were 51 cases where money had to be returned to the consumer, and 100 cases where it was necessary to request the consumer to pay sums varying from 1d. to 3s. 8d. where the cash in the box was deficient.

The number of what may be termed subsidiary complaints received at the office, and attended to, from Jan. 1 to Aug. 31 of the current year was 123 ; and their nature as follows :—

Bent pennies and coins stuck	42
Complaints as to rubber connections for griller	20
Foreign and silver coins used	8
Stoppage in fittings and other repairs	53

In the case of the item "foreign and silver coins used," I may mention that the meter had in one case been put to a use never contemplated, I feel sure, by the makers—viz., for the purpose of a savings bank; the good lady having inserted four two-shilling pieces into the box in place of four pence, so that they would be, for some time at any rate, safely under lock and key. The majority of the complaints named above are due to the insertion of bent pennies, and people being nervous when they are putting the coins in, and consequently allowing them to fix. Another point is that very few people will prepay more than two or three pennyworth at once; and, unfortunately, with most of the meters we have had experience of, we find that, unless something like the full complement of coins is inserted together, the attachment index and the meter index beg to have different views on the situation.

Before sending out any meter, we run it through a test, in the first instance to see if the valves are closed; it is then attached to the test holder and a gas-fire, and four pence inserted in the slot. The amount to be consumed at the rate of 22½ cubic feet per penny is therefore 90 cubic feet; and they are allowed to pass if they do not give less than 83 or more than 93 cubic feet for the 4d. If not within these limits, they are rejected. The following table shows the results of 356 tests made with five different makers' meters on these lines :—

	Meters Tested.		Number Rejected.		Per Cent.
A.	213	..	13	..	6·10
B.	31	..	1	..	3·22
C.	56	..	4	..	7·13
D.	28	..	2	..	7·13
E.	14	..	1	..	7·13

One interesting fact in connection with the introduction of coin-meters into Scarborough is that houses in older parts of the town, which years ago were the domiciles of the more affluent members of the community, and fitted up with gas, but which, owing to the march of events and extensions of the town, have been on the down-grade and left to the fisher-folks, have, after a lapse of 20 to 25 years, again become illuminated through the agency of the "penny-in-the-slot" meter.

That the principle of the prepayment meter system is undoubtedly right, and that, as far as it has gone, the gas world have scored a distinct success with it, appears to me to be indisputable. What we now require is to have the details rather more fully perfected, so that the troublesome readjustments with the consumers at present necessary may be done away with. I feel sure that, with the adoption of a broad and generous policy, we shall be able to make the use of oil quite unnecessary, and that gas will become not only the universal light in the class of property under consideration, but that it will also become the medium of all their culinary operations as well.

That, in my own town at least, there is plenty of scope, is evident, as out of 9000 inhabited houses in the borough we only number at the present time some 5133 as gas consumers; and I have no doubt whatever the large proportion of our other towns are in much the same position in this respect.

Discussion.

The PRESIDENT said the subject of the paper was now before them. It was one upon which many of them had had experience —both with penny-in-the-slot meters and in the encouragement of small consumers in other ways.

Mr. H. TOBEY (Malton) had listened with much pleasure to the paper Mr. Holliday had given them, and the interesting details in it. Mr. Holliday began by speaking of the benefit which was likely to accrue to humanity by the adoption of the penny-in-the-slot meter, on account of its being free from the dangers of the oil-lamp. The danger of oil-lamps was very great indeed. He saw by the report of the Metropolitan Fire Brigade, recently issued, that the number of fires occurring from lamp accidents in London alone was something like 450 a year. The number of lives lost amounted to about 33. Of course, this did not include a great many of the minor casualties which occurred, but were all the cases which were reported to the Fire Brigade, and dealt with by them. There must, however, be a vast number of cases which never were reported—small accidents which did not come before the Fire Brigade. He thought they might take these as at least double the number reported; so that the total would be about 1000 in London in one year. If these accidents could be decreased by means of the use of gas through penny-in-the-slot meters—and most of such accidents occurred in small dwellings—no doubt the loss of life and property arising from lamp accidents would be very much less. He had had some experience himself with prepayment meters. He must say that with the meters with which he was first supplied he had some difficulty; but with those he was now getting he had not the same difficulty. The meters were now so improved that he thought they could be used without incurring much annoyance, either from pennies getting fast or people getting gas for, perhaps, two or three days, or longer periods, and they not being aware of it, and then having to ask the consumer to pay up the difference, which was always a matter of annoyance. He had formerly known a consumer put in six consecutive pennies before he was able to get a supply of gas; but now the improvements in construction of the meters enabled them, he thought, to rely upon the meters giving the exact quantity of gas for which they were rated. He found that the average consumption per meter was something like 10,000 cubic feet per annum. This was not a very large quantity; but still he thought it was a quantity which paid. Of course, the extra rate charged should be sufficiently high to yield a return for the extra cost of the meter and the cost of the service to the small consumer. Their charge for gas at Malton was 3s. per 1000 cubic feet; and they rated the gas supplied by prepayment meters at 25 cubic feet for 1d., which was 3s. 4d. per 1000 cubic feet. But he should remark that, in addition to this, they did not charge meter-rents to ordinary consumers, which was equal to about 2d. more. So that, really, the difference between the two rates would amount to about 6d. per 1000 cubic feet. Of course, there were consumers and consumers; and what might be considered a large consumption in one place might very well be reckoned small in other places. He found, in his own case, that the average consumption per meter was about 30,000 cubic feet per annum. Some might not consider this as large; but in districts like theirs, they reckoned that 30,000 cubic feet was a considerable consumption.

Mr. E. H. MILLARD (Durham) said he had listened with great pleasure to the paper; and he was only sorry that the title did not lead them to infer that the prepayment system was to be referred to; otherwise he should probably have been prepared with some details on the subject. He thought that perhaps Mr. Holliday had some new system which he was to enlighten them upon; but he found it was the well-known penny-in-the-slot meter which stood in the foreground. With respect to monthly consumers, he might say that, before going to Durham, he had a very similar system at work. He used to collect every fortnight; and those consumers were charged the same price as the ordinary ones. In approaching this question, it was evident they must take into consideration the cost of producing the gas, as well as the selling price. In this, he thought, lay the whole *crux* of the question. Some of the engineers of large works had been twitted with not being up to date with the prepayment system. He confessed himself that, if he were selling gas at (say) 2s. 6d., he should be chary of going in for either prepayment meters or monthly collections, unless there was a considerable margin. He had worked out the number of consumers and the consumption for several works, confined to the county of Durham; and he was surprised to find that, in taking out the leakage, the leakage per consumer ranged very high. They were all agreed, he thought, that the leakage question was largely dependent upon the services; and he did not think they lost more, per service, with the large consumer than they did with the small one. Therefore, the leakage, which amounted, on an average, to about 2500 cubic feet per service per annum, was large. Wrought-iron services would give way; and they might expect the leakage to go on. He did not know whether Mr. Holliday made a separate charge for meter-rent. With the small consumers, it was quite evident that the 10d. per 1000 feet extra alone would not cover that. He saw that Mr. Holliday had had to come round to fitting up the houses. He did not think the automatic supply system, without the companies taking up the gas-fitting, was worth anything at all. Another point which was well brought out in the paper was that, without a griller, a penny-in-the-slot meter was not worth much to Mr. Holliday, as would be seen from the large consumption he obtained during the summer months. With regard to the money not tallying with the meter registration, he did not know whether it was altogether wise to insist upon the few extra coppers being paid, or to give the consumers back the few coppers which were in excess. He was afraid that any such policy would tend to destroy the confidence of the user in the penny-in-the-slot meter. Although at Durham they had had experience of both too little and of too much money, they had not yet instituted the principle of charging a penny for a pennyworth of gas. The idea as to making the money-box a savings bank, he did not think would be strange. They frequently found that a two-shilling piece had been dropped in for a penny; but the consumer always knew that he had put it there. He found himself very

much in agreement with Mr. Holliday in his paper. The only thing he had doubt about was whether even 9d. or 10d. per 1000 cubic feet was sufficient to cover the difference between supplying small consumers, on account of the low average consumption, and the leakage they would have per consumer.

Mr. J. HALL (West Pelton) said that, with regard to the leakage which had been referred to, it had not yet been explained how it arose. Was it from the time the penny was put into the slot till the meter started again that it went on? He had had no experience in the matter. If there were a waste on that account, it would be judicious on the part of gas companies to make their charges so as to cover any such loss.

The PRESIDENT said he did not think the intention of the paper was to raise a discussion upon leakage. Mr. Holliday, he thought, referred to leakage in connection with the difference between the amount of money in the box and the quantity of gas consumed. It was not so much a question of leakage in the services as of the difference between the coin put in and the quantity of gas used. But let them discuss the matter in a general way. He knew that a good many gentlemen had adopted the prepayment system, and some of them had had considerable experience with it; and he hoped they would take this opportunity of stating what they knew about it.

Mr. TOBEY said he would just like to add the fact that the number of consumers in Malton had increased by 20 per cent. since they adopted the penny-in-the-slot meters.

Mr. J. WHYTE (Seaham Harbour) said his experience with prepayment meters was not very great, but such as it was he should be very pleased to lay it before the Association. He had somewhere about seven dozen of them at work. With reference to the discrepancy between the cash and the quantity of gas consumed, he had had some difficulty in that way. In the case of one or two meters, which were the first fixed, the gas and the money agreed to a penny piece. But he had given back as much as 8d. and 9d.; and in one instance they were about 3s. 9d. short. In that case he simply took out the meter, and said nothing about the matter. His conviction was that if they once said the meter was wrong, it would be altogether condemned by the people; and he considered that the best and easiest way out of the difficulty was to lose the 3s. 9d. He wanted to try to press the business a little. This summer they had been at considerable expense in laying down plant for the public lighting of a neighbouring parish; and he meant to try to push business there. He proposed to put in the fittings. He knew that in some cases they would lose as much as 15d. or 18d., and in other cases they would make a few coppers. But his contention was that they ought to get in prepayment meters, and obtain an increased consumption. They charged only 3d. extra for them. Their price to ordinary consumers was 3s. 6d. per 1000 cubic feet, with no meter-rents; and with prepayment meters, their charge was 3s. 9d.

Mr. T. BOWER (West Hartlepool) said he could not add anything to the discussion in the way of experience; but he was exceedingly glad to have had the pleasure of listening to the points that had been put before the meeting. In his town, they had done nothing whatever in the way of adopting prepayment meters; but he was inquiring into this, and the matters mentioned that day would be of use to him. He once had some experience with "slot" meters; and one of the things he found was that the money did not agree with the gas consumed. In one or two cases, when they asked for the balance, they were told to take out the meter; but the suggestion was made that, if the consumers were satisfied with the gas consumption except on the point in dispute, they would take out the penny-in-the-slot meter, and put in an ordinary one at a reduced price. This brought them several new consumers; and for them, credit ought really to be given to the penny-in-the-slot meters. If meter-makers would now turn their attention to making these meters more perfect, there was a wide field for them. He had no doubt the makers would do what they could. He was sure they were all very much indebted to Mr. Holliday for bringing his experience before them; and he believed they might profit by it when the time came for taking up the matter.

Mr. WHYTE said he would like to add that in some cases consumers had to put in from 4d. to 6d. before they had any gas.

Mr. J. H. PENNEY (South Shields) considered they were very much indebted to Mr. Holliday for the facts he had placed before them with reference to encouraging small consumers. He thought that one very important phase of the question for most of them was, seeing that the electric light might, sooner or later, claim many of their larger consumers, such as manufacturers, they should do all they possibly could to get hold of the smaller consumers. No doubt these, along with the middle classes, would be the backbone of their rental; and he regretted to learn, from Mr. Holliday's paper, that the prepayment meters were not such a great success as they were led sometimes to believe them. The fact that the prepayment meters showed such variations as he had mentioned was not satisfactory at all. He thought that the letting out, free, of a ring burner or a simple gas-bracket, to small consumers, would be of great advantage. They generally found that the rental to a poor consumer was a great bar to his commencing the use of gas; but if they "wrapped it up," in some way or other, with the price, he had no doubt at all that these people would adopt gas. By so doing, gas suppliers would add to their receipts. They had had no experience with prepayment meters at South Shields; and therefore he was sorry that he could not add anything more to the discussion.

Mr. MILLARD said he should like to supplement his remarks with one point. The grillers which they supplied along with prepayment meters had been so much appreciated by the consumers that they had come to consider that they could not have a griller without a prepayment meter, and they asked to have their own grillers exchanged so that they might get a prepayment meter. In order to meet their views, he brought the matter before his Directors, and suggested that they should fix the grillers and make a charge of 6d. per half year for them. They had now a large number of these grillers out, solely through the penny-in-the-slot meters advertising them. He might say that they invariably put the gas-fire down by the side of the fireplace, resting on the fireplace during the summer, and any fumes that came from it went up the chimney. He thought it might be worthy of the consideration of any of them whether they should not adopt the method of hiring out grillers, and charging 6d. per half year for fitting them up.

Mr. W. FORD (Stockton) said he really would not have risen, unless it had been to confirm an expression of opinion by Mr. Penney. In his town, he was sorry to say, the electric light in large works was superseding the use of gas to some extent; and though they were a corporate body, he was afraid they would not be permitted to do as their friends did at Durham or Seaham Harbour, in introducing gas-fittings. Corporate bodies were subject to the ratepayers; and ratepayers sometimes indulged in such reflections as: "He may supply the gas, but not the fittings." That might have some effect upon the introduction of penny-in-the-slot meters. A working man might find a griller a very useful thing to have, in enabling him to get something hot before he went out in the morning; and especially if his wife were ill. Penny-in-the-slot meters seemed to be condemned—he thought rather hardly—by Mr. Holliday; but it was a new industry, introduced very recently. The manufacturers of the meters had displayed a great amount of ingenuity in their construction; and they must have a little patience with them. Give them time to perfect the instrument, and he had no doubt that, before a few years had passed away, the penny-in-the-slot meter would be quite as reliable as any meter they now had. He was very sorry indeed he could not add anything to their experience. About five years ago, his Corporation authorized him to introduce the penny-in-the-slot meter. He did that by advertising. He put the meters into every plumber's shop in the town, with a large placard stating that they could be had at the gas-works, free of charge—no meter-rent and all connections made free. Yet, notwithstanding that this advertisement continued for twelve months, the total applications made to the Gas Department were for only three meters. One of them was returned on change of tenancy; another was sent back because it was too much trouble to put the penny in the slot, and an ordinary meter was demanded; and the third one, he was sorry to say, broke down. He thought, as had been said, that where gas was cheap—say, 2s. per 1000 cubic feet—there was not that inducement to corporations or companies to persevere with the introduction of prepayment meters, because, if the production of gas were at the maximum, and they increased the output by these meters, they would have to enlarge the works to supply the small consumers. He was very pleased indeed that Mr. Holliday had shown so clearly to them that the rising generation were not going to be behind those of them who had passed through the greater part of their experience; and he wished all their young friends every success.

Mr. J. COATES (Ottawa) said he had no right to speak, because he was not a member of their Association. He had come from Australia, and he was now Manager of a large gas-works at Ottawa. He should like to ask the reader of the paper, or some member of the Association, what the experience was with those who would not pay. If they cut off a man's supply of gas, he took to electric light; but if they just said to him, "We will not supply you with gas on the ordinary terms, but we will put in a prepayment meter," he would be bound to pay. He did not know if they had any experience of this kind—whether they had tried it upon consumers who could afford to pay but would not. He was fighting three electric light companies at Ottawa, and was doing well; so that, if gas could beat them on the water-power question, surely they could beat them on the coal.

Mr. TOBEY said that, when they found a consumer who would not pay, they gave him the option of two things—he must either make a deposit, or he might have a penny-in-the-slot meter; and he would not have any more gas unless he accepted one of these alternatives.

The PRESIDENT, before calling upon Mr. Holliday to reply to the discussion, made a few remarks. He thought the title fully bore out the text of the paper. The encouragement of the small consumer naturally suggested, in the first place, the penny-in-the-slot meter, although it did not confine itself to that. He noticed that Mr. Holliday's average sale of gas per meter was about 8000 cubic feet per annum. This corresponded very nearly with his own experience. They had something like 120 of these meters in use, which was about 16 per cent. of their total consumers. Last year they had an average consumption with these meters of 7500 cubic feet. This year there had been an increase; and he thought the average might now be quite 8000 cubic feet. This increase was due to the introduction of more cookers. When they introduced the system, they let out

grillers on hire; and he quite agreed that, without letting out fittings and some appliance for cooking, the penny-in-the-slot meters, in small towns, could not make much headway. The meters had been the means of advertising cookers and other methods of consuming gas, as had been mentioned by himself already, and by another speaker. At the time of introducing the system, they had a number of old cookers, which had probably been in use for nine or ten years, and which it was difficult to let out, as people preferred to have new ones. The penny-in-the-slot meters enabled them to place them in the district; and in this way, they had been very lucrative for them. He had now gone beyond this, and had put in a few new cookers of small size; and he was disposed to think that the more they went in for the supplying of gas-cookers to the smaller class of consumers, the more they would benefit. He thought they had a wider range than Mr. Holliday; but he did not intend to have it long. If they did not go beyond 2000 cubic feet per annum, he thought they were hardly worth the capital outlay involved; and they should take the meters out, and place them where they would be more remunerative. As to the reliability of the prepayment attachment, he was very glad that Mr. Ford had spoken about it. There was no doubt that prepayment meters had been hurried on the market—not so much by the meter-makers as by the demand; and there was no doubt, too, that the meters were not perfect. But they were improving rapidly. Each series of meters which came out from the various works was an improvement on what had gone before; and he believed they would soon reach to a system of perfection as near as possible. They were allowed a range of 5 per cent. with ordinary meters; and they were told that the range for prepayment meters only went up to about 7 per cent. These were the points he wished to emphasize before getting Mr. Holliday to reply; and he would now ask them to accord to the author a very hearty vote of thanks for coming forward with his paper.

Mr. Holliday, in reply, said that with regard to what had been taken as adverse criticism of the prepayment meter, he was sorry if his paper had given such an impression, because he could say that nothing was further from his mind than to do so. He believed that the prepayment meter was one of the things they should forward as much as they could. All he had said he had based, as far as he could, on facts. There was no doubt that as soon as the makers of meters had had time to perfect them more—and they were doing so every day—they would get a thing of practically automatic working. With regard to the returning of money, or the asking for more money, they in Scarborough came to the conclusion that the best thing to do was to let the matter run for three months before adjusting the money. If there was more money than there should be in the box at the end of the first month, they informed the consumer, but left it in; if there was less money, they told him, equally, that there was not enough in, but left it. In the bulk of the cases, it righted itself by the end of the three months; and they did not trouble themselves with demanding payment if it did not. On the question of waste, he might say that it was not waste, but simply a question of the quantity of gas consumed, and the amount of the coins not tallying. Of course, there was no waste so far as the gas itself was concerned. As to the introduction of penny-in-the-slot meters in cases of bad payers, they found these meters worked very well indeed. In a great many instances, with ordinary meters, they were called on to put pressure upon consumers, quarter after quarter, to get the money in; and they had had in this way to put penny-in-the-slot meters into houses larger than they had ordinarily to deal with in their town.

Vote of Thanks to the President.

Mr. J. H. Cox (Sunderland) proposed a hearty vote of thanks to the President for the very able address he had favoured them with. He was sure it would be found to contain a great many useful thoughts which would repay consideration afterwards. Altogether the meeting had been a great success.

Mr. Ford, in seconding the motion, said it was one of their greatest pleasures that one of the younger members should come forward and take office. He hoped that other young members would come forward similarly, in their turn.

The President thanked the members for the vote. He said that, if in anything he had written he had added to the interest or improvement of the Association, he could assure them that it had been a great pleasure to him. This visit of the Association came at a very busy time of the year to him; but he had somehow managed to get through it all. He hoped the members would leave Hexham with pleasant recollections of their visit. When he accepted the presidency of the Association, he had the assurance within him that from the gentlemen with whom he was associated they would have a very hearty welcome. He was quite sure that his Directors welcomed them all heartily to Hexham; and he did the same.

The members of the Association and a number of friends were afterwards entertained to dinner by the Chairman and Directors of the Hexham Gas Company, in the Hydropathic Mansion. Dr. Stainthorpe, the Chairman of the Company, presided over a company of about eighty. The visitors were, at the conclusion of a hearty and generous entertainment, driven to the railway station in time to catch the evening trains going east and west, and all left Hexham highly gratified at the success of the meeting and the cordiality of their welcome to the ancient and interesting place.

MR. VERNON HARCOURT ON GAS PRODUCTION AND CONSUMPTION.

The educational facilities offered to students by the Goldsmiths' Institute, at New Cross, are undoubtedly among the most complete in London; and the evening classes cover many subjects, the instruction in which is both theoretical and practical. The work of the session which has just commenced includes a course of 28 lectures on gas manufacture. The first twelve will be devoted to the chemical side of gas production and consumption; and they commence next Friday with destructive distillation, and proceed week by week to the finished gas, including the chemical principles of enrichment, and conclude with the treatment of residuals. This series will be in the capable hands of Mr. A. G. Bloxam, F.I.C. Mr. A. J. Lineham will deliver the remaining sixteen lectures, which will deal very completely with the plant and apparatus on a gas-works and the means of distribution and consumption. The work of this particular branch of study was opened, last Friday evening, by an introductory address by Mr. A. G. Vernon Harcourt, F.R.S., one of the Metropolitan Gas Referees, on which occasion the Prime Warden of the Goldsmiths Company, Sir Frederick Abel, Bart., K.C.B., &c., presided.

Mr. Harcourt, in his opening remarks, said it could not be necessary to explain to those who were attending, or going to attend, the classes of the Institute, how desirable it was to blend knowledge with practice. To understand as far as possible the reason for what we do, and the nature and causes of what we see, was the natural desire of every intelligent and well-directed mind. But we can only work out a little for ourselves. To discover what were the essential conditions, and what was the nature of such changes of matter as happened in the manufacture and consumption of gas, had occupied the attention and thought of many observers during several generations. The discovery was far from complete. What the real changes were which took place in a gas-flame was at the present moment a matter of active controversy among professors of science. Still there was a large body of well-established truth; and it was only those who had learnt these general truths who could rightly understand what they saw, or could hope to add to the sum of knowledge.

Dealing with the need and nature of artificial illumination, Mr. Harcourt said the gradual development of mankind, and his advance in civilization, had had the effect of increasing the importance of those pursuits in which the sense of sight was needed. There were few things, besides sleeping and listening to music, that could be done best in the dark. The natural supply of light was excellent in quality; but the duration of sunlight during more than half the year was insufficient. We need at most eight hours sleep; but we have, on an average, eleven hours of darkness. Therefore, civilized man had learnt to provide himself with artificial light. Fire (which, whenever man first lit one, or saw one which the lightning had kindled, must have been recognized as a source of light, similar to the sun by day) was first used for such purposes as cooking, pottery and metal work, and also served as a source of light as a beacon of communication or warning. The need of domestic light, and skill in supplying that need, was one of the later accomplishments of man. What might be taken as a type of artificial light was an iron bar that had been heated in a forge—that was to say, a solid substance which would bear a strong heat without being dissipated, and without any other necessary change than that of growing bright. Nearly all the sources of light used were of this kind. The substances that had this property of remaining unchanged at a high temperature were those that we use. The carbon, not quite pure, but retaining some hydrogen, in ordinary flame lights, and both the carbon of the arc electric light and the filaments of the electric incandescent or glow lamp were similar to those substances which gave light to gas-flames. To these must be added certain earths or oxides, which were the solid substances of the brilliant incandescent gas-light, and also of that which had been used much longer—the lime-light. A substance was needed that not only could become incandescent, but was a source of heat. The sources of heat were either gas-flames or the electric current. All the flames used in the lighting of houses were gas-flames. The oil which rose in the wick of the lamp was changed by the heat of the flame into gas before it burned; and the grease of the candle was changed by the heat of the candle flame first into an oil (which was the liquid grease in the cup of the candle), and this afterwards becoming very strongly heated and decomposed at a high temperature constituted the flame. That which happened in the wick of the oil-lamp or candle was done on a large scale in the retorts of the gas-works. Solid or liquid substances were there partly converted by a strong heat into gas, which was then distributed through pipes before it was burnt.

Turning to the substances which furnished light when daylight failed, Mr. Harcourt said that, generally speaking, they

were products of life. Just as, almost without exception, the substances which were used for food were products of either the animal or vegetable world, so the substances employed to give light after darkness set in were similar substances—namely, compounds mainly of hydrogen and carbon. Of such substances, some gave more gas and more brightly burning gas than others; and only those had been chosen as sources of light which were most suitable, and could be obtained most abundantly. The fat of animals gave liquid oil for lamps and solid grease for candles; and, again, the vegetable world yielded oil. Many seeds, for instance, when very strongly pressed, gave off oil. There was another source of such substances. By the gradual change of temperatures, or by the effect of the interior heat of the earth, the relics of a former vegetation were changed into gas (which gas had been used extensively in America), and very largely into liquids of the paraffin class, called petroleum. Long before petroleum came largely into use, a similar substance was made by the heating of shale, by which solid paraffin and liquid of a similar composition were produced and employed for lighting. The great store of the remains of living things were the deposits of coal. That which had been stored, and still remained to us, seemed to be only that which, under particular conditions, had been so enveloped that it had been preserved for us; and it was this remnant of former life which served us for gas illumination and for many other things. The abundance of these deposits made them the chief source of artificial heat, light, and mechanical energy. The mining and carriage of coal formed a part of the complete history of manufacture of almost every industry; and therefore could not be regarded as forming specially a part of the manufacture of gas. Still, in the manufacture of coal gas, coal played a double part; being used, as in other manufactures, for heating the material dealt with and under the boilers of the steam-engines, while it was also the raw material of the manufacture.

The processes and chemical changes by which the coal was made to produce gas for use were next lightly dealt with by Mr. Harcourt. In this connection, he said that the change that took place in the retorts at the high temperature employed was most complete. The elements that had been living together for a long time in the coal entered into new combinations—forming a large number of the combinations of which they were capable. The products, or rather the chief part of them, were of the simpler kind, because of the prolonged exposure at a high temperature. There was this complication, however, that they did not have, as the product of this destructive distillation of coal, only those substances which would be permanent at the high temperature ultimately obtained; but the great mass of material gradually passed through the whole range of temperature lying between that which the charge had in the open air and the bright red heat of the coke when drawn. During this time, there were being given off a great variety of substances—some owing their origin to the heating of the materials at one temperature, and some at another. He had checked himself in saying that it was only the simpler compounds that survived, because it happened that they had in the coal tar that came off a great variety and complexity of materials. Broadly speaking, the substances divided themselves into two classes—those that were solid at a high temperature, and those that were volatile at a high temperature, and went forward into the hydraulic main.

Condensation and purification having received attention, the use of the gas as an illuminant was enlarged upon. Alluding to the batswing and fishtail or union burner, Mr. Harcourt said that, owing to the great economy found in first starting to use these burners, and their simplicity, he believed that the chief part of gas lighting would, for long to come, be of this kind. There had, however, been many improvements. Of the great advances that had been made, the first was that which was due to one of the brothers Siemens—that was, the heating of the air supplied to the gas; the heat being derived from the combustion of a portion of the gas itself. He believed one of the earliest proposals of this kind was an Argand burner provided with a double chimney; the two chimneys being so placed that the air to feed the gas burning within the inner chimney had first to flow downwards between the chimneys, and so pass over the surface of the inner one. The air was thus heated; and it was proved that the yield of light so obtained, in spite of the slight obstruction of the two chimneys, was considerably more. In the regenerative burners, of which many types had been introduced since the first one by Mr. Frederick Siemens, the principle was in all cases the same—viz., the heat of the gas was applied to a metal structure; and the air was thus heated before coming into contact with the flame. The principle was the same as that which had been used in furnaces in obtaining a higher temperature. By the use of burners of this kind (which had been a good deal simplified, and made less unsightly) a large gain—approaching perhaps the doubling—of the light which the gas would otherwise have yielded had been obtained. But far the greatest advance was the introduction of the incandescent gas-light. That really passed out of competition with any of the other contrivances for increasing the amount of light that could be obtained from gas. He tested one of these in the Quadrangle in which he lived at Oxford. The burner seemed to give its best result with a consumption of 4 cubic feet of gas per hour; and, when burning this amount (which in an ordinary, fairly good burner, would afford a light of something like 12 candles), the light given, after the gas had been deprived of its light-giving power by the mixture of air, and then caused to play on the mantle, was 60 candles—that was to say, the light was multiplied by five. The enormous gain in the relation between the gas consumption and the light which was realized, made it difficult not to believe that it would come—as, indeed, it was coming now—very largely into use. To the chemist the incandescent gas-light was an extremely interesting subject.

In describing next the methods by which the illuminating power of the gas is measured and the quality estimated, Mr. Harcourt pointed out that our eyes are quite incapable of judging of any other relation between two brightnesses than that of equality; and, in proof of this, he referred to the experiments (in which he took part) at the South Foreland some years ago to compare the relative excellence of an electric arc, a large oil-lamp, and a large gas-lamp for lighthouse purposes. Night after night, and especially on foggy nights, they observed and measured these lights. The Elder Brethren of the Trinity House, who had chief charge of the experiments, issued instructions which were circulated among the captains of vessels that were sailing by the South Foreland, and asked them to put down what, in their judgment, was the relative brightness of the three lights. There was great discrepancy between the results so arrived at and the results found by photometrical measurements. Man was not, Mr. Harcourt said, capable of forming such an estimate. The only way of estimating the brightness of lights was to get two illuminants, and bring them together so as to make them equal. There was, he mantained, one considerable difficulty in photometrical measurements when applied to the object of knowing what was actually the value and use of the light—viz., that the measurements of the light given by different burners were almost always made simply in the horizontal plane; while consumers always avoided using gas in the horizontal plane. The gas when tested was burnt at a certain rate—viz., 5 cubic feet an hour, and with a particular burner, because the same quality of gas, burning at another rate or in another burner would give a totally different value. This was a matter that could not probably be changed. The present mode of describing the quality of the gas had this disadvantage, that most consumers of gas did not understand what difference it made to them that the gas should be of one or other quality. Any gas consumer would say, and say quite truly: "It is said the gas is sometimes a good deal better, and sometimes not up to the proper quality; but I do not notice any difference." There were two reasons for this—one that we have a very small appreciation of the difference of the brightness of flame, and the other that, until it was seen at what rate the gas was burning, as well as the brightness of the flame, nothing was known about the quality. It should be understood that the real way in which the lowering of the quality affected the consumer was that, in order to get the same amount of light, he wanted, and had to pay for, more gas. If they took the quantity of gas a consumer had to burn, and pay for, to get the light that he required, the qualities and differences would be better understood than they now were. It had been proposed by Mr. George Livesey, and he (Mr. Harcourt) thought there was a great deal in the proposal, that gas should be supplied of a somewhat lower quality than that distributed at present in London. It was required that the gas should have an illuminating power of 16 candles. He believed it was certain that gas of a rather lower quality could be produced at a considerably less cost than that of 16-candle gas. In order to obtain a gas of the value of 16 candles from the coal ordinarily used, it had to be enriched, or it would not reach that standard. It was said it would be better not to do this; and he was inclined to hold that those who said so were right. Naturally, the gas consumer would demand that, if a change were made, such an alteration should also be made in the price of gas that he would be able to obtain as much light as now for his money, using the same burners. That would not be at all a difficult matter. The Gas Referees had been devoting some attention to this question, to find out what the difference would be—how much more gas would have to be burned, in order to procure the light that was now got from 16-candle gas. This being ascertained, it was purely a matter of rule-of-three to find out what the price of the gas should be. Two great reasons for this change, he thought, were the increasing use of gas as a source of heat both for cooking and motive power, and its use for lighting by means of the incandescent burner. No doubt, the more highly illuminating gas was productive, volume for volume, of a greater amount of heat; and therefore it was the better gas for warming houses or for mixing with air and burning with the incandescent mantle. But he believed it would be possible to get a great gain as far as any of these processes were concerned—the obtaining of mechanical energy, heat, or incandescent gas lighting—by burning a larger quantity of gas of a lower grade, which would cost less than the slightly smaller quantity of more valuable gas which was now used. For all purposes, the change might be made with advantage, if proper consideration was given to the necessity for lowering the charge for gas.

In concluding his address, Mr. Harcourt referred to the valuable bye-products of gas manufacture. Alluding to coke, he remarked that the late Sir William Siemens used to hold that the proper way for heating houses was not by burning coal, and that, if the use of coal could be superseded, it would rid the London atmosphere of smoke, which would be a great

advance. Sir William's opinion was that the coal should be converted into coke, which could be consumed in fire-places in conjunction with a certain portion of gas. He (Mr. Harcourt) believed that, in a properly constructed grate, this mixture could be used with great advantage. Although it might not have quite the brightness and variety of a coal fire, still it would be a considerable benefit. The gas could be turned down, and the coke allowed to burn on; and then it could be brightened up again by increasing the supply of gas. Whether such a process would not entail too great an increase of expenditure to balance even the advantage of the smokeless air might be doubted, as only to a partial extent would the disadvantages of the coal fire be got rid of. The other residuals produced in the manufacture of gas were also touched upon.

On the motion of Sir FREDERICK ABEL, a cordial vote of thanks was passed to Mr. Harcourt for his kindness in being present and delivering his interesting address.

Mr. J. S. REDMAYNE, B.A., the Secretary of the Institute, proposed a vote of thanks to the Chairman for presiding; and this having been seconded by Mr. HARCOURT, was carried with applause.

Incandescent Gas Lighting for Railway Stations.—The Paris, Lyons, and Mediterranean Railway Company have decided to adopt incandescent gas lighting at a number of their stations. Something like 4500 lights will be required for the purpose.

Prizes for Original Research.—The Royal Society of New South Wales offers its medal and the sum of £25 for the best communications on original research in certain specified subjects; among them being "The Chemical Composition of the Products from the so-called Kerosene Shale of New South Wales," and "The Mode of Occurrence, Chemical Composition, and Origin of Artesian Water in New South Wales." The competition is open to all, and is not subject to any restriction, save that the communication, to be successful, must be either wholly or in part the result of the competitor's own original observation or research. Particulars may be obtained from the Hon. Secretaries of the Society, 5, Elizabeth Street, Sydney.

The Respirability of Flame-Extinguishing Atmospheres.—Professor Frank Clowes, of Nottingham, recently gave, before the Chemistry Section of the British Association, an account of further experiments carried out by him on the respirability of air in which a candle-flame had burnt until it was extinguished. An atmosphere containing 16·4 per cent. of oxygen, 80·5 per cent. of nitrogen, and 3·1 per cent. of carbon dioxide would, he said, extinguish the flame of a candle, yet would not only be respirable, but might be breathed for some time without injury by a healthy person. An atmosphere, however, which would extinguish a coal-gas flame appeared to approach closely the limits of respirability, so far as its proportion of oxygen was concerned. Professor Clowes expressed the opinion that candle and lamp flames should be discarded, as tests of the respirability of air, in favour of the flame of coal gas.

Testing for Sulphur in Gas.—Herr Collan has been investigating the subject of the estimation of sulphurous and sulphuric acids in the products of combustion of illuminating gas; and he has recorded his conclusions at some length in the *Zeits. für Anal. Chem.* It has been maintained by certain experimentalists that the sulphur in illuminating gas is burnt directly, and almost completely, to sulphur trioxide or sulphuric acid. The author has shown that these conclusions are open to criticism, on the ground that sulphur dioxide in alkaline solution is easily oxidized to sulphur trioxide in contact with excess of unburnt oxygen; and that, as a matter of fact, upwards of 90 per cent. of the sulphur is burnt to sulphur dioxide. Four experiments gave the following results: (1) 93 per cent., (2) 89, (3) 99, and (4) 93. The first three were made with a smoky flame; the fourth, with the flame of an ordinary Bunsen burner.

The Temperature of Visibility of Hot Bodies.—Signor Pettinelli has published in the *Nuovo Cimento* a new determination of the lowest temperature at which a hot body becomes visible. He heated a cast-iron cylinder 30 centimetres long and 14 centimetres broad in a wrought-iron jacket over a Bunsen burner to a temperature of 460° C., as indicated by an air thermometer, and then observed its flat end in a dark room from a point 60 centimetres above it. When it had cooled to about 415°, the red heat vanished, and gave way to an indefinite hazy glow. This glow completely disappeared at 404°; and repeated observations gave an error of only 3°. Highly emissive substances, such as the mantles used for incandescent gas lighting, became visible at the same temperature. Reflecting surfaces, however, had to be heated 20° higher before they appeared to the eye; and glass still more. These low-temperature rays were found to traverse glass and water like ordinary light-rays; but they suffer a comparatively greater absorption. Different eyes vary slightly in their capacity of seeing them—the maximum divergence being about 6°. But then the extent of surface must be the same. Signor Pettinelli found that, if he screened off all but 1-40th of the surface, the body had to be heated 6° higher than before to become visible; if 1-200th, 20° higher; and if 1-800th only was exposed to view, the minimum temperature of visibility was 460°. Hence he rightly concludes that the contradictory results obtained by previous experimenters are due to differences in the areas of the hot bodies investigated.

REGISTER OF PATENTS.

Incandescent Gas Lighting.—Friedlander, H.; a communication from C. M. Lungren, of New York. No. 16,925; Sept. 5, 1894.

This invention relates to the manufacture of the bodies or frames placed over gas-burners, which become incandescent by the heat from the lighted gas.

The incandescent bodies as now made, says the patentee, are produced from various earths "by saturating an open-meshed textile fabric with the solution or emulsion of such earths, and incinerating the fibre. They, however, present the defect that the composition of the materials gives a peculiar greenish white colour, and makes the light unsuitable for some purposes; and moreover the method of manufacture adopted makes these articles extremely delicate, so that they readily break or become damaged, and hence unfit for use."

For producing incandescent bodies according to this invention, a mixture of the oxides of thorium, lanthanum, and didymium is used. Suitable proportions are as follows:—

Oxide of thorium	96 to 98 per cent.
„ „ didymium	1 to 2 „ „
„ „ lanthanum	1 to 2 „ „

This gives a white light with a slightly yellow tinge. The proportions of the didymium (causing the yellowness) must be small, as this substance causes a considerable coloration of the light; but the proportions of lanthanum may, if desired, be increased. Thorium oxide makes the article capable of resistance and durable. Lanthanum oxide may, however, be substituted therefor without sacrifice of that advantage. Thus, 98 per cent. of lanthanum oxide and 2 per cent. of didymium oxide may be employed in the manufacture. By increasing the proportion of didymium oxide, the colour of the light is made more yellow. About 5 per cent. will probably be the limit of such addition.

The manufacture of such incandescence bodies from the oxides of thorium, lanthanum, and didymium, or of those of lanthanum and didymium alone, is effected as follows: The materials are finely pulverized, and mixed in the above-indicated proportions, and then made into a dough or paste by a cementitious material—say, liquid glue. The dough or paste is forced out from a press cylinder in threads, which are afterwards woven into a net; and from this tapering cap-like bodies are made, which, by suitable holders, are fixed over the flame of a gas-burner. By adding glycerine to the dough or paste, it is kept elastic after it is pressed out to shape, and will not readily become hard and brittle.

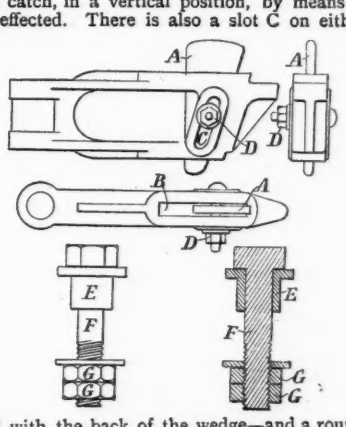
The net-like structure made as above is next dried, and then burnt to remove the glue or other cement; and this makes the thread-like material hard and rigid. To burn the cap, it is put on a mould corresponding to the shape required, consisting of platinum wire, or other fireproof material—say, porcelain, clay, or fire-clay; and the cap and mould are heated to such a degree as to entirely remove the lime or the like. The material of the article is then hard and firm, and can be handled for fixing on the burner without falling to pieces.

Atmospheric Gas-Burners.—Newton, H. E.; a communication from R. N. Oakman, of Greenfield, Mass. No. 21,348; Nov. 6, 1894.

This invention relates to "an improved burner-device for illuminating gas, natural gas, or combustible gas, which device is particularly adapted to be placed in the fire-boxes of stoves, hot-air furnaces, steam-heating furnaces, and boilers." The object is to provide for simultaneously controlling the supply of gas and the primary supply of air to the mixing tube and chamber, and also to control the secondary supply of air to the burner-nozzles, by means of a gas-valve and a sleeve and damper for the air supply. The gas-supply valve, and the air-inlet ports, are simultaneously controlled by one lever, and by a single movement thereof, whereby complete combustion of the gas is always ensured, and, at the same time, lighting-back is prevented. The secondary air supply to the burner-nozzles is also controlled by the same lever handle and connecting-rod. Perfect control is thus had of the gas supply, the primary air supply for mixing with the gas, and the secondary air supply for causing complete combustion at the burner-nozzles.

Adjustable Catch and Cross-Bar Attachment for Retort Mouthpieces.—Braidwood, J. F., of Greenwich. No. 22,850; Nov. 26, 1894.

This adjustable catch for the cross-bar of retort mouthpieces is somewhat similar in shape to those now in use, but is capable of adjustment by means of a wedge A, passing through two slots B, in the end of the catch, in a vertical position, by means of which the adjustment is effected. There is also a slot C on either side of the



catch—parallel with the back of the wedge—and a round hole in the wedge. A small bolt D is passed through the two slots in the cheeks and the round hole in the wedge; so that, when the wedge is adjusted, the bolt is tightened. In this way, the wedge is held in the position

required; thereby ensuring perfect adjustment of the lid, and enabling the eccentric lever to tighten in any desired position.

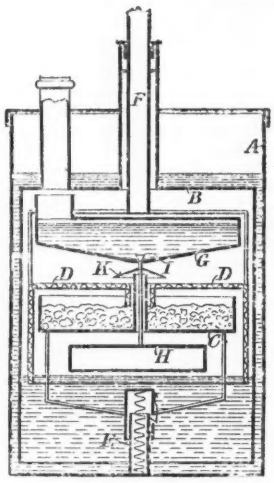
The usual method of adjusting the distance of the cross-bar from the lid, says the patentee, is by means of an eccentric bolt, which is first turned on two different centres; the nut end being $\frac{7}{8}$ inch diameter, while the upper half of the bolt is $1\frac{3}{8}$ inches diameter. Throughout the bolt on one side there is a straight line; the whole of the projection in the centre being on the opposite side—thus forming an eccentric. The bolt is passed through a hole in the bracket on the lid; while the small end is passed through the cross-bar underneath the bracket. By turning the bolt by its head, the eccentric portion affects the cross-bar, and removes it to or from the lid. In place of the eccentric bolt, however, a metal bush E with a flange on the upper side is inserted in the bracket on the back of the retort-lid, with a hole in the centre, $\frac{3}{4}$ inch in diameter, through which and the cross-bar a bolt F is inserted, and secured in position by two lock-nuts G.

Preventing the Freezing of Water-Supply Pipes.—Curtis, H. P., of Oadby. No. 5931; March 21, 1895.

This invention is designed with the object of effecting such improvements in the construction of water-supply pipes as will prevent the freezing of the water therein during frosty weather. The essential feature of the invention consists in surrounding the pipes with a stationary volume of air, which may be effected by enclosing the service-pipes in one or more outer or casing pipes of larger diameter, and then subsequently soldering (or otherwise securely stopping up) the ends or joints of the pipes, so that the air is imprisoned between the service-pipes and the outer or casing pipes.

Acetylene Gas-Lamp.—Rossbach-Rousset, F., of Tempelhof, near Berlin. No. 11,783; June 17, 1895.

This invention relates to a gas-lamp in which acetylene is obtained by the decomposition of carbide of calcium in such a manner that "the water required in the decomposition is (proportionately to the quantity of gas burnt at the burner, or to the pressure of the same) drawn through wicks and supplied direct from a water container past a valve operated by a float, or is conducted to the carbide of calcium by one of these means."



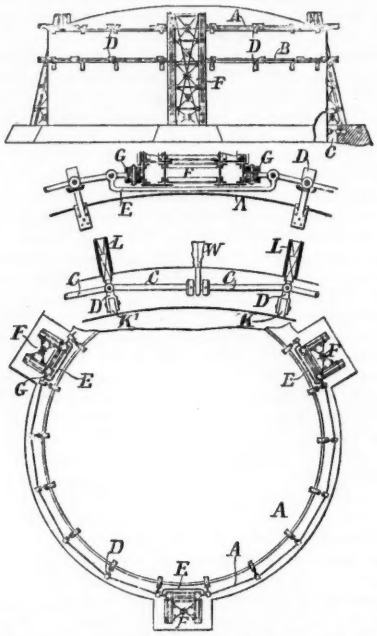
A is an outer casing; B, a pressure casing; C, a carbide of calcium container; D, a wick or wicks; E, a spring with a catch or pawl; F, the pipe leading to the burner; G, a water container; and H, a float, with a valve I. The container in which carbide of calcium is placed is normally pressed upwards by the spring E, and moves downwards against the resistance of the spring according as the volume of the decomposed carbide of calcium increases. Its upward movement is limited by a spring catch taking against one of several projections on a tubular part which encloses the spring, but disengageable when desired.

The water for the decomposition of the carbide of calcium is drawn partly from the water in the lower part of the casings through the wicks D, and distributed in fine particles over the carbide of calcium, and partly supplied direct from the water container G past the valve I, which is operated by the float H. The water first falls upon the guide-cone K, and then spreads out on to the wick. Upon the commencement of the evolution of the gas, the float lifted by the water will open the valve I, and water will flow past this to the carbide of calcium through the wicks in the form of fine particles. When the requisite gas pressure is attained, the float falls, lowers the level of the water, and the valve closes. The further supply of water then takes place through the wicks; so that the supply of water to the carbide of calcium is regulated automatically by the pressure of the gas.

Guide-Framing for Gasholders.—Hacker, H., of Berlin. No. 11,981; June 20, 1895.

This invention has for its object to overcome certain "defects" in the construction of gasholder guide-framing as known at the present day.

In his specification, the patentee remarks: Guide-frames of gasholders at present generally consist—except in cases where the latter are surrounded by walls—of vertical pillars or standards erected around the holders. As these pillars are very expensive, they have sometimes been replaced by ropes and chains, passed over rollers, and arranged so as to surround the holder in both a vertical and a horizontal plane. In some cases, ropes and chains have been used inside the holder; such ropes and chains being connected to a ring guided in its up-and-down movements by an internal pillar or hollow column. Guide-framings such as these have the following defects: (1) They are accessible only with considerable difficulty for inspection and repairs. (2) As the whole strain due to wind pressure, or weight of snow, is liable to be thrown on one part of the structure, it necessitates the whole being very strongly built, and so that any one part will be capable of resisting (when necessary) the whole strain. Such construction is both laborious and expensive. The ordinary guide-framing erected above the water-tank, and consisting of a large number of columns connected together by rings and tie-bars, has also the defect that, owing to expansion and contraction, due to changes of temperature, the guide-rollers are not always in contact with the sides of the bell. Moreover, in the case of very large holders, they are apt to alter their shape slightly under changes of temperature; and they also have a tendency to assume a slant position, owing to accumulations of snow, or pressure of wind on one side, or to friction in the guides. Experience teaches that, even when the guide-rollers are accurately adjusted at first, they have to be subsequently loosened, in order to prevent any possibility of the holder, when raised, remaining suspended, and to avoid too great frictional stress, during the up-and-down movements of the holder. As a consequence, it usually happens that only two or three of the guide-rollers transmit the pressure to the columns. This is very dangerous, as the roof of the holder, when the latter is swayed about by shifting winds, exerts a powerful thrust, which requires to be received by the various parts of the columns, since the roof, on account of its stiffening, cannot descend within the fixed columns. Therefore, to prevent any possibility of accident, all the columns have to be made very strong, as the wind pressure may be exerted in any direction.



The engraving shows an elevation and a plan of a holder having three stays or supports; also detail views drawn to an enlarged scale.

The holder is surrounded by the rings A B C, consisting of ropes, chains, rods, or the like. The rings A and B are carried by brackets D secured to the holder. These rings are provided with coupling-straps E, which pass along inside of, and partly round, the standards F, in such manner as to be capable of moving in a vertical direction only. When the holder is moved laterally by wind pressure, the rings at the side opposed to the wind are placed in tension. Consequently, they bear against all the brackets at that side, so that contact between the holder and the rings is effected at a great many points.

The rings are carried in the ends of the brackets D, so that the latter are only subjected to horizontal strains in a radial direction, and receive (apart from unavoidable frictional strains) no other horizontal strains. Moreover, between each pair of standards F, all the brackets exert the same pressure on the holder, except in those cases where frictional strains may make a slight difference. The rings thus transmit the pressure exerted by the holder to the front sides of the standards F, where tangential rollers G or bronze-plates are interposed, for the purpose of reducing friction. Therefore a holder with three standards only requires six rollers or bronze plates, instead of, as in other cases, 18 or more.

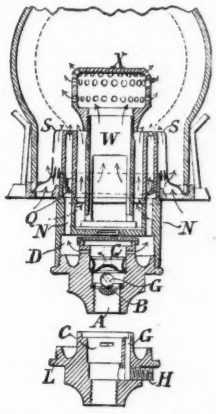
Between the front or inner sides for the standards and the parts E of the rings, there is sufficient space left to prevent contact between them ever taking place. The standards are therefore only acted upon in one direction—that is, if the friction of the rollers is left out of consideration; and as the rollers are at both sides, a state of equilibrium is produced, in consequence of which these standards need not be made so strong as similar guide-frames. It is also unnecessary to have so many of them as usual.

Instead of the standards F, iron columns can be used for small holders, and be fixed at their lower ends or be stayed by ropes or wires, in the same manner as high iron chimney-stalks. Rings E¹ are so fitted on the columns as to be capable of sliding up and down; and to these rings (which replace the friction plates) the large rings A and B are fixed. Instead of such rings, a rope can be used, passed right round the holder, and fixed to it in such a manner as to be raised and lowered therewith. The rings are connected by rope ends, or the like, to the rope passed round the holder.

The lower guide-ring C is arranged just above or below the water-level in the tank, so that either no water at all, or a very little, need be allowed to escape in order to get at it. The ring C differs from the rings A and B, inasmuch as it is not raised along with the holder lifts, but maintains its position, while the lower lift (should there be one) passes through it. Such a ring is shown formed of chains, ropes, or rods held in place by bars and brackets D, secured in the wall of the water-tank. The bars, which are fitted securely in the wall at intervals, perform the same function as the standards F. The brackets, which have rectangular shanks, and carry on their ends bearing-rollers K, are capable of sliding in and out of rectangular guide sockets or liners L fitted in the wall. The rectangular shape of the liners and shanks prevents the brackets having any movement other than a radial and horizontal one. With this arrangement, should the holders move sideways, that part of the ring C which faces the wind is subject to tension, so that all its rollers K bear against the holder.

Gas-Heating Burners.—Goodson, J., of Vauxhall Bridge Road, S.W. No. 13,879; July 20, 1895.

This invention relates to burners of the Argand type—specially applicable for heating purposes. It has for its principal object to "so regulate and distribute the gas and air supply as to produce perfect combustion of the gas, and consists essentially in supplying the air necessary to support combustion centrally and externally in a particular manner, and in automatically regulating the gas supply to suit varying pressures."



The gas enters at A, and passes through a gauze disc B into a governor-valve chamber C, closed by a cap, and in which works a valve having a perforation for the passage of the gas to the chamber. A side passage or bye-pass G, whose cross area is regulated by a screw H, also conducts gas to the chamber C, from whence it escapes to the burner. The central portion of the valve is cut away, so that the top and bottom portions only come in contact with the surface of the chamber C, in order to reduce frictional resistance. To a flange on L is screwed an intermediate piece, having two passages N, which convey the gas to an annular space O at the base of the steatite portion of the burner. At the lower portion of the burner, a perforated metal ring Q is placed, which acts as a distributor, and causes the gas to flow evenly through the burner before it issues at the points of ignition. Around the upper portion B is attached a gallery, having at its lower side a series of holes for supplying air to the outer portion of the flame. Attached to the gallery, and concentric with the burner, is secured a deflector S, having a series of holes near its base. In the central part of the burner is secured a tube W, having portions cut away to enable air to be supplied to a head X screwed on to the top, and having a series of perforations around it for distributing the air. The gallery also has attachments for holding a chimney in position.

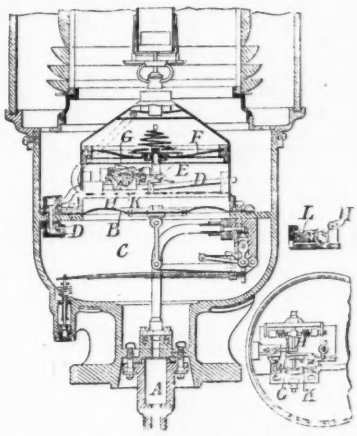
The action of the burner is as follows: The gas supply, on entering the burner, first flows through the gauze disc B, then a portion passes through the central orifice in the governor-valve, and operates it in the usual manner. Another portion flows through the passage G, which acts as a bye-pass; the amount passing this way being regulated by the screw H, so that the burner can be set to consume a certain amount of gas in a given time. The gas which flows from the chamber C into the annular space D now enters the passages N, and passes through the distributor Q and steatite portion of the burner, and is ignited at the orifices. A current of air is thus induced through the several openings (as shown by arrows), and "causes the gas-flame to be highly charged with oxygen, and so produce an intense heat." This, says the patentee, can "be utilized for many purposes, and especially for heating living-rooms where syphon or other gas-stoves are used, as, owing to the perfect combustion of the gas, no smoke or smell is produced."

Intermittent Gas-Lights.—Rickman, W. B.; a communication from R. & O. Pintsch, of Berlin. No. 14,115; July 24, 1895.

This invention relates to apparatus employed on buoys, beacons, and elsewhere, for giving intermittent or flashing lights; the gas which supplies the flame being freely admitted to the burner for a time, and then for a time nearly stopped, and so on alternately.

The drawings show a vertical section of the automatic intermitting apparatus, a plan of the valve-gear, and a part section of the graduating valve.

The gas entering at A passes a regulating-valve, and into a chamber C covered by the flexible diaphragm B, to which is connected the lever of the regulating-valve, acted on by an adjustable spring. According as the diaphragm is raised or lowered by the pressure in the chamber C, the valve closes or opens more or less the gas-inlet, so as to maintain the pressure constant (or nearly so) in the chamber. From C, the gas passes by a pipe D to an opening furnished with a valve which, when open, admits gas into an upper chamber E. This valve is on the one arm of a lever K, the other arm of which carries a valve covering the opening to a pipe which leads to the burner. When one is open, the other is shut; and conversely. The chamber E is covered by a flexible diaphragm F, pressed down by a spring. To this diaphragm is attached a vertically sliding stem, having a pair of collars, with a pair of sharp-edged studs, between which is engaged one arm of a lever. The other arm G is made as a fork, engaging somewhat freely between its prongs a stud projecting from an arm of a rocking-shaft H, which has springs bearing against its arms. On H, there is a pair of arms with adjustable screws, between which is engaged a stud projecting from the lever K.

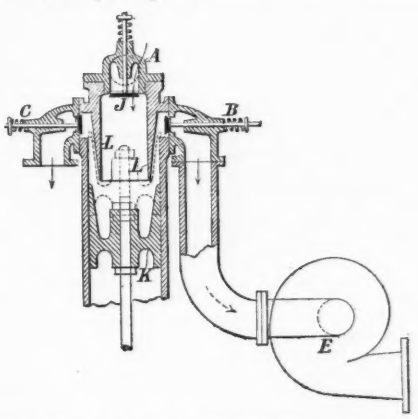


Assuming this lever to be in the position shown, gas entering the chamber E by the open valve causes the diaphragm F to rise, and raises with it the stem and the studs. By this action, the lever G is moved, and also the rocking-shaft H; its arms compressing the springs until they pass their horizontal position. They then cause the shaft to make a sudden movement—such that one of the screws is rapidly withdrawn from, and the other is rapidly brought against, the stud on the lever K, so as to cause one valve to close and the other to open. As the gas passes to the burner, the diaphragm F descends—producing a reverse action of the valve-gear; and this action is automatically repeated as long as gas is supplied, the flame burning brightly when E is open, and being all but extinguished when E is closed.

As so far described, the valve mechanism is known, and has only been detailed in order to make clear the improvements which form the subject of the present invention. In the first place, each of the valves is mounted between a pair of side springs, which, on passing the point of maximum compression, cause the valves to close and open suddenly. It has been found, however, that the sudden opening of one valve causes an increase of flame so rapid that sufficient air could not at once reach the burning gas—the combustion being so imperfect that the lamp glass soon became blackened. In order to provide against this, a small coned valve is held down by a spring closing a passage L leading to the burner. On the rocking-shaft H is fixed a stud which, as the shaft turns slowly through the first portion of its stroke, before it receives the sudden movement due to the springs, moves a pair of levers, so as to slowly lift the valve, and allow a gradual supply of gas to the burner before the valve opens to give its rapid supply. The flame thus has a gradual increase—"permitting access of sufficient air to effect complete combustion."

Gas-Engine.—Dürr, F., of Berlin. No. 14,385; July 29, 1895.

This invention relates to a gas-engine in which the ways to be taken by the combustible and the products of combustion, and the valves, are arranged in such a manner that the engine makes a complete cycle in two strokes of the power piston.



The power piston K is shown in one of its extreme positions or dead-centres—after it has completed the outstroke. The dotted lines show the other extreme position of the piston—after it has completed the in or return stroke. At the beginning of the return stroke (preferably during the first quarter), the gas-valve A, and the discharge-valve B, are opened simultaneously. The valve A is actuated by any suitable automatic valve-gear, and serves to admit the combustible gas

mixture; while the valve B communicates with any suitable suction apparatus E, operated automatically by the engine. The combustible gases drawn into the engine enter first the chamber J, and drive the waste gases or products of combustion resulting from the previous working period to the valve B, from which they are rapidly drawn off by the suction apparatus E. The bottom of the working cylinder has a cylindrical inward projection J, which extends into the cylinder, and forms between the inlet and outlet a guide, partition, or shield adapted to prolong the way of the combustible mixture. The valves A B close again, after having remained open during about a quarter of the stroke of the power piston.

The combustible mixture, which then remains in the cylinder, and cannot escape, is compressed during the remainder of the piston stroke; and when the latter has been completed (the piston being in the position indicated by the dotted lines), it is ignited by any suitable mechanism, so that the work of expansion begins when the piston commences the following outstroke. As soon as the piston again approaches its outermost position, so that it leaves only about one-quarter of the stroke to be completed, the automatic valve-gear opens the valve C, so as to relieve the pressure in the cylinder, and closes again at the end of the piston stroke. When this has taken place, the processes of charging, compressing, and expanding are repeated.

APPLICATIONS FOR LETTERS PATENT.

17,382.—GIBB, D. M'C., "Gas cooking-stoves." Sept. 18.

17,385.—BROOKES, W. H., "Gas and other similar globe holders." Sept. 18.

17,472.—LYON, J. H., "Apparatus used in connection with the manufacture of gas, and commonly known as the hydraulic main." Sept. 19.

17,533.—GARDNER, H., "Supporting or holding incandescent gas lighting filaments." A communication from the *Société Française de l'Héliogène*. Sept. 19.

17,670.—CAYROL, J., "Gas-burners." Sept. 21.

11,848A.—LAKE, H. H., "Apparatus for mingling gas or air and acetylene gas or other enriching gas for illuminating purposes." A communication from E. N. Dickerson. Sept. 23.

17,728.—SCHROEDER, A., and WEHNER, J., "Liquid-meters." Sept. 23.

17,742.—CUTLER, S., "Safety fittings for water-gas generators." Sept. 23.

17,746.—GABE, H., "Decomposing calcium carbide." Sept. 23.

17,795.—VOELKER, W. L., "Incandescent gas-lamps." Sept. 24.

17,848.—SEXTON, M., "Pipe-joints." Sept. 24.

17,849.—TOBLER, A. C., "Gas-regulators." Sept. 24.

17,850.—GREENALL, J., and HEATON, T. T., "Meters for fluids." Sept. 24.

17,878.—LISTER, F., "Road or other vehicles propelled by gas, steam, electric, or like motor mechanism." Sept. 25.

17,927.—THOMPSON, W. P., "Bunsen burners, incandescent burners, and the like." A communication from A. Bandsept. Sept. 25.

17,973.—RAMSBOTTOM, R., and ROPE, H. J., "Cartridge for illuminating purposes." Sept. 26.

17,974.—STERNBERG, F., "Lamps." Sept. 26.

17,977.—MORTON, J., "Manufacturing tapered gas-retorts." Sept. 26.

17,997.—HOLLIDAY, T., "Gas-burners." Sept. 26.

18,012.—KENT, H. A., "Self-lighting gas-burners." Sept. 26.

18,018.—CROIZAT, V., "Incandescence, electric, and gas lamps and lanterns." Sept. 26.

18,025.—BAGSHAWE, B., WORTH, F. G., and FOX, S., "Generators for the production of acetylene gas." Sept. 26.

18,041.—SCHNEIDER, H., "Generation of acetylene gas." Sept. 26.

18,060.—BICKERTON, H. N., "Gas-engines." Sept. 27.

18,076.—ILLINGWORTH, C. R., and ARTHUR, D., "Recovery of ammonia from sewage and other ammoniacal liquors." Sept. 27.

18,090.—HILL, J. K., "Fluid meters and turbines." Sept. 27.

18,188.—MAYER, E. L., "Detecting and indicating the pressure of fire-damp or other noxious gas or gases in the atmosphere of mines and other places." Sept. 28.

The Price of Gas at Sowerby Bridge.—A proposal was made by Mr. J. Greenwood, at last Wednesday's meeting of the Sowerby Bridge District Council, that all resolutions respecting the price charged for gas, except those relating to Luddenden Foot, Mill Bank, and Brearley, be rescinded, and that the price be reduced, from October 1, as follows: Mills at Triangle and beyond, 2d. per 1000 cubic feet; to all other consumers inside and outside the district, 3d. Mr. Greenwood said the price now charged in Sowerby Bridge was 2s. 6d., and at the mills at Triangle 3s. 2d. The present consumption of gas was, inside the district, 60 million feet, and outside the district, 17 million feet. The consumption of the mills at Triangle, &c., was 8 million feet. Should these figures be maintained, the result of making the reductions he proposed would be a loss of revenue amounting, roughly speaking, to £1100. The gas profits last year were £3346, including a balance of £500 brought forward from the previous year. Deducting £1741 paid to the sinking fund, this left them with a net profit of £1605. He, however, estimated that this year they would effect a saving of £300 in the price paid for coal. Then there would be a reduction of £125 in interest; and he calculated that they would have an increased consumption of gas amounting to 4 million feet, the profit on which would be £100. He was willing to admit that they would probably have losses on other heads; and he thought he was making a liberal estimate in allowing £588—viz., £243 for reduction in receipts from coke, and £345 on the income from sulphate of ammonia. These figures showed that, even after the price of gas had been reduced as he proposed, they would still have a profit from the undertaking of about £412; and he held that it was their duty to sell gas at as near cost price as they possibly could. Mr. Wood admitted that the profits last year were as stated by Mr. Greenwood; but he found that, for the past five years, the average profits, after paying the amount due to the sinking fund, had only been £456. It was generally thought it would not be wise to reduce the price at present; and the motion was rejected.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Question of Gas Finance.

SIR,—The exceedingly important question raised in the first of your "Editorial Notes" on the 10th and the 24th ult. deserves the most careful consideration by the directors and managers of gas companies who wish to keep their place in the race, and to hold their own against all competitors. The last sentence—"This is, in a nutshell, the case for making all gas capital redeemable"—is startling, if it means that the redemption or extinction of *all* gas capital is contemplated; for that would mean the extinction of the companies themselves, and would leave the property without an owner, and with no one interested in its prosperity except the consumers. In short, the Collectivism of the Socialists, so far as the gas companies are concerned, would be an accomplished fact. I do not for a moment suppose this is your desire. I believe you are utterly opposed to Socialism, of which Herbert Spencer stated quite recently his "belief to be that the advent of Socialism will be the greatest disaster the world has ever known, and that it will end in military despotism." I believe Socialism to be impracticable, impossible; though the propagation of the idea has done, and may do very much more, mischief. I therefore protest against any tendency in that direction.

"All gas capital" can only be redeemed by the authority of Parliament; and that authority will never be given to the companies. The shareholders would have to be compelled to accept cash for their shares or stock; and it would be necessary to make the consumers find the money, for the only source from which it could be obtained would be by an excessive charge for gas. The premiums on the issue of new stock could never do it, because these are only obtainable by the issue of new and additional stock or shares. You cannot reduce and increase at the same time. But if redemption were possible, it would be neither desirable nor just. If gas consumers are to be supplied at less than cost price, which equally includes cost of manufacture and interest on capital, it must be at the expense of others—either the providers of the capital or those who have redeemed it. Such an unjust system, like injustice of all kinds, cannot be desirable; and it is doubtful whether it would be beneficial to the consumers themselves, because the motive of self-interest, which now prompts gas directors and managers to do their best for the consumers, would be entirely absent. Redemption, therefore, or even (what is the same in kind) any absolute reduction of capital, being out of the question, there remains the possibility of a relative reduction or its practical equivalent—a reduction in the amount required to pay interest on capital per 1000 cubic feet of gas sold. This being one of the most important questions gas directors have to face, I will now show what has been done, and what may be done, in this direction.

The capital charges of gas companies consist only of interest on loans or debenture stock and dividend on capital. The charges of corporations are for interest on loans, sinking or redemption fund, and appropriations in aid of rates—the last in England, but not in Scotland, where gas undertakings are not worked for the benefit of the ratepayers at the expense of the consumers. In 1884 and 1894, according to "Field," the average charges per 1000 cubic feet sold were as follows:—

	1884. Pence.		1894. Pence.
Metropolitan companies	15·17	..	13·00
Suburban ,, ...	14·79	..	12·03
Provincial ,, ...	10·49	..	9·32
Corporations	11·55	..	9·19

The average reduction in the case of the companies in the ten years is, as near as may be, 2d. per 1000 cubic feet; while that of the corporations is a trifle more. Averages, however, must only be taken for what they are worth; and in this instance they do not show what can be done. Those companies that were lowest in 1884 have not, of course, as a rule, decreased their charges at the same rate as those which were highest. One of the Suburban companies which was very high has come down nearly 7d., but in this case the business has increased 100 per cent; while the company which was lowest has only come down 1d., and its business increased but 50 per cent. There is, however, one Suburban company (the Wandsworth) whose charges in 1884 amounted to only 11·42d. per 1000, which has come down to 8·34d. in 1894. But here, again, the business has doubled in the ten years. This general progress is satisfactory. One cannot but feel, however, that, if special attention had been given to the question, it might have been considerably greater; and let us hope that it will be greater in the next decennial period.

There are three legitimate ways in which this relative reduction of capital, or of interest upon capital, can be effected. Starting with the axiom that capital ought to be represented by value in the shape of works, plant, and cash in hand for working capital, it follows that where this is not the case—and it is nearly everywhere—the capital ought to be reduced until the amount per ton or per 1000 feet sold is represented by assets. This can, and may fairly be done by gradually making extensions, and renewing obsolete with more efficient plant out of revenue until the balance is restored. The question naturally arises: What is a fair proportion of capital, or at what cost per ton of coal, or per 1000 feet sold, could a given company be now started? £5 per ton has for a long time been the figure in men's minds; and, as an average, it is perhaps not very wide of the mark. But since this figure was first used—and it was referred to as a standard, to my knowledge, quite thirty years ago—great changes have taken place. On the one hand, apparatus has been improved, and some parts, such as gas-holders, greatly cheapened; and certain materials—especially iron—are lower in price. On the other hand, more elaborate and more costly apparatus is required, such as labour-saving machinery, which, with cooking-stoves and the supply of weekly tenants on the automatic system, has created a new and additional demand for capital. I do not think that companies of first-class magnitude could be started now, and completely equipped, at much less than £4 per ton—say, between £3 10s. and £4; while for medium-sized concerns, between £4 and £5,

according to circumstances, would be necessary, and small undertakings again would require (say) something between £5 and £6 per ton of coal used in the year. It would be quite safe, at any rate, to take these figures as points to which to work down, partly on the plan above mentioned, and partly by using the utmost economy in laying out capital on additional works. If the growth of business is met by a capital expenditure of £2 10s. or £3 a ton on the increase, there will, in a few years, be a perceptible relative reduction of capital, dependent, of course, on the rate of increase.

The other, and perhaps the most effective, plan for reducing the charges for interest is not by way of a relative reduction of capital, but by raising all new stock at the lowest possible rate. With one or two exceptions, where it has already been done, gas companies have a grand opportunity in this direction. The amount of capital raised in the form of debenture stock is much less than they can well carry. Therefore they should not issue any more ordinary stock until they have raised debenture stock equal in amount to not less than one-third of their total paid-up ordinary capital. The rate at which such stock can now be raised is about 3 per cent., which, in a fairly increasing business, will soon pull down the average interest on the capital, and thus materially reduce the charge per 1000 cubic feet sold. In one case, this operation alone has brought down the average charge for interest and dividend about 3 per cent., with about another 1 per cent. by premiums on the sale of ordinary stock.

When these possibilities are considered, and one thinks of what might have been done, and is even now possible, the question arises what is the real use of directors; for, with few exceptions, they seldom give attention to these points. They cannot be expected to know much about gas management, but are generally fortunate in being served by capable officers. They, however, should know something about finance. They are well paid. The fact is, gas profits come too easily. There is not sufficient stimulus to cause directors to give anxious thought and earnest effort to the business, to make them give attention, among other very important questions, to this vital one of finance, and its bearing on the price of gas. It is now thirteen years since Parliament first sanctioned the issue of debenture stock equal to one-third of the total paid-up ordinary capital; provision being made that debenture stock only should be raised until these proportions were attained. But how little has this important precedent been followed. It has been repeatedly urged upon gas companies; but they have usually regarded the suggestion with absolute indifference—evidently not seeing either its necessity or its value.

Gas companies cannot be considered to be in a perfectly sound condition until their capitals are represented by actual value, nor until the charge per 1000 feet for interest is brought down to a reasonable figure, which will be found to be much below the amount now required in nearly all cases. Probably from 6d. to 8d. per 1000 feet might be regarded as reasonable, and to be worked for; and then they need have little fear of comparison with municipal gas undertakings. This will give most gas companies an object for some time to come.

In your "Editorial Note" in the JOURNAL for Sept. 24, you say "that the London gas consumer has still to pay for every penny of gas capital raised in the dawn of the industry, and to a very large extent unrepresented by assets." In the days—more than thirty-five years ago—when competition existed, and dividends were not so large or so secure as they have been since, the companies were very sparing in the issue of new capital, with the result that in the twenty years from 1840 to 1860 the capital lost in the early days was very largely redeemed. The capital per ton of coal of the South Metropolitan Company was reduced from £18 in 1840 to £5 in 1860; and in the latter year the Chartered Company's capital was only £5 per ton. The mischief from which gas companies now suffer was mainly done in those so-called prosperous years—but which, in another sense, were most unfortunate for the industry—from 1860 to 1875, when full dividends on any amount of capital were practically guaranteed, and there was every inducement to encourage, with nothing to check, the propensity to issue additional capital. The figures I have given, showing the reduction in the charge for interest during the last ten years, prove that some progress has been made; and now that you have drawn attention to the question, it will be the fault of directors if it is allowed to drop.

Whether it is right that consumers under local authorities should be called upon to redeem capital for the benefit of the next generation, is a question that it would be useless to discuss. I do not think any municipal trading is advisable or justifiable; and certainly it is just that the consumers of any article should pay such a price as will cover not only the cost of manufacture, but also the equally fair charge for interest on the capital required to carry on the business.

Reigate, Oct. 2, 1895. GEORGE LIVESEY.

The Oil-Gas Experiments at Bradford.

SIR,—We regret that Mr. Lewis T. Wright's letter of Sept. 14, which we saw for the first time on the 28th ult., and certain conclusions which have been drawn therefrom, compel us to state the actual facts of this unfortunate controversy.

On March 28 last we reported to the Gas Committee upon a 33 days' continuous working of the Dvorkovitz process, and, as the result of that trial, gave the cost of enrichment as 0·42d. per candle-thousand.

We purposely used the expression "candle-thousand" as being the simplest, and as the one which Mr. Herring adopted in his paper of May, 1894. This value of a "candle-thousand" has, to our knowledge, only been applied to "the quantity of enrichment required to raise the illuminating power of 1000 cubic feet of gas by one candle." The Gas Committee were familiar with Mr. Herring's paper and with the value of a "candle-thousand."

In a communication sent on April 4 to a private member of the Gas Committee, Mr. L. T. Wright stated that the result "0·42d. per candle-thousand" was "incorrect," and that the correct cost was "*five times as much*." This serious blunder, so persistently adhered to by Mr. Wright (as also by Mr. Frank Wright), and now as persistently evaded by him, has been the cause of all this unpleasant dispute.

We at first thought that this error of Mr. Wright's arose from his unfamiliarity with the use of the term "candle-thousand;" and we expected that, when he found out his mistake and the confusion it had caused, he would be anxious to at once correct it. Unhappily, however, Mr. Wright declined to discuss the question with us; stating, in a letter dated April 13, that "if the Committee thought the cost per candle-thousand was brought out fives times too low, there was no misinterpretation to correct."

Mr. Wright attempts to obscure the mistake he made by comparisons with our use of the term "foot-candles" in a former report. We have for many years invariably used the term "foot-candles" to represent cubic feet multiplied by illuminating power. We have all along admitted that the value

$$\frac{\text{cubic feet} \times \text{illuminating power}}{5}$$

has generally been called "foot-candles," or "candles," instead of by the correct name of "candle-hours." This customary use of the term "foot-candles" we maintain is technically wrong; but this question shall be dealt with on some other occasion.

Mr. Wright complains that our opinions on the cost of cannel enrichment vary from time to time; but so do the prices of cannels and of their residuals. Mr. Wright's calculations of the cost of cannel enrichment in Bradford in recent years are very amusing. Taking the illuminating power of the gas at the four Bradford works from 1890 to 1893, and the illuminating power of the coal gas made at the Thornton Road works during the abnormally severe weather of February, 1895, Mr. Wright calculates (?) the enriching value of the cannel purchased by the Corporation two months ago. Mr. Wright was furnished with full particulars of the coals used in Bradford; and he, having "special knowledge on the subject of coals and cannels," must surely be aware that many of these Yorkshire coals, being of the very best quality, yield 17 to 18 candle gas, instead of 15½ candle as he assumes. It is therefore clear that all his calculations and deductions upon this assumption are utterly worthless.

Mr. Wright thinks 0·84d. per gallon a fair price for 10-oz. ammoniacal liquor. We think that most gas managers would be glad to obtain this price at the present time, when liquor is quoted at less than half this price. The figures from which Mr. Wright has calculated his value of liquor represent the profits of our chemical works for the year 1892-3, and include profits on the manufacture of acid and other products. Mr. Wright also forgets that some of the coke from the cannel at 13s. 3½d. is practically unsaleable. Mr. Wright appears to think that estimates of cannel enrichment, once made, should hold for ever; and he combines cannel prices of one year with calculated enriching values of another, and with calculated values of bye-products of a third year, in a most delightfully original manner. We prefer to modify our estimates according to the actual values at the time.

The concluding paragraphs of Mr. Wright's letter are based upon two more "fallacies." First, "that our letter of Sept. 3 deals with a case of the enrichment of 18¾ to 23 candle gas." This, however, is not so. It deals with the enrichment of 15¾-candle gas to 18¾ candles, in precisely the same way that Mr. Wright calculates the enrichment by oil gas in his report. We took the increase in bulk of 18¾-candle gas, due to the addition of cannel gas, at 14·44d. per 1000 cubic feet, because Mr. Wright in his report valued the increase in bulk of 17·73-candle oil gas at 13·66d. per 1000 cubic feet. In the second place, Mr. Wright's remarks are based upon the "belief in an impossibility"—namely, that the whole of the 23 candles in a 23-candle gas can be utilized for enriching 15¾-candle gas. Mr. Wright has forgotten that, if the mixture is to be of 18¾-candle power, the cannel gas forming part of this mixture must also be 18¾-candle power. Therefore, only 4¼ candles (= 23 − 18¾) are available for enriching the 15¾-candle coal gas. If all the 23 candles of the cannel gas could be taken for enrichment, then this gas would have absolutely no illuminating power left.

In conclusion, we must express our sincere regret that Mr. Wright should have shown such a lack of professional courtesy as to refuse to discuss the matter with us in a friendly spirit, while writing privately to a member of the Gas Committee to discredit our report and statements. Had he agreed to our request in the first instance, most of the succeeding unpleasantness would have been avoided.

Gas Office, Bradford, Oct. 2, 1895. WM. WOOD. CHAS. WOOD.

SIR,—Were it not for Dr. Dvorkovitz's offensive references to myself in connection with his oil-gas process under trial at Bradford, and my report upon the misuse of figures regarding same, I would not have troubled to reply to his letter in your issue of Sept. 24, nor you to insert the same in your columns.

It is true that, about the commencement of April, I was consulted by the Chairman and members of the Gas and Electricity Committee of the Corporation of Bradford to advise them upon the calculations used in regard to the Dvorkovitz oil-gas process; and in justification to them, as well as myself, I must say that the matter was put to me in a thoroughly unprejudiced manner, without mention of names, or the production of any documents. I was simply asked to adjudicate between the calculations put forward by a certain person A in contra-distinction to those of another, B.

In order not to extend this letter to undue length, I will give the problem as it was submitted to me—

There is a difference of opinion existing here between A and B, as to the proper way to calculate the cost of enrichment. I append the calculations as worked out by each of them. Would you kindly oblige by looking over the same, and mark in red ink which is correct, and so help us out of our difficulty. If both are wrong, would it be too much to ask for you to correct us?

The problem is:

400 gallons of oil, labour, &c., cost £8 3s. 4d.

400 gallons produce 27,200 cubic feet of gas of 105-candle power, and 160 gallons of bye-products.

160 gallons of bye-products being equal to 35,000 cubic feet of gas, what is the cost per 1000 foot-candles of enrichment?

A's Calculation.

35000 c. ft. of gas. 160 gallons.

2100000
35000
5600000

27200 c. ft. of gas. 105 c. p.

136000
272000
*2856000 foot-candles.
5600000
8456000 total.

27,200 × 105 . . . . . = 2,856,000
160 gallons of bye-products × 35,000. = 5,600,000
8,456,000 foot-candles.

Cost $\frac{£8\ 3s.\ 4d.}{8456}$ = 0·25d. per 1000 foot-candles of enrichment.

B's Calculation.

35000 c. ft. of gas. 160 gallons.

2100000
35000
5)5600000
1120000 foot-candles.

27200 c. ft. of gas. 105 c. p.

136000
272000
5)2856000
571200 foot-candles.

27,200 × 105 ÷ 5 = 571,200
35,000 × 160 ÷ 5 = 1,120,000
1,691,200 foot-candles.

£8 3s. 4d. reduced to farthings.
20
163
12
1960
4
1691)7840(4⅝ farthings.
6764
1076

4⅝ farthings per 1000 foot-candles of enrichment.

My reply was as follows:—

Taking A's calculation, the figures I have underlined and marked* should read "one-fifths of candles per cubic feet," and not "candles per foot," or "foot-candles." I must confess to not thoroughly understanding how the 5,600,000 foot-candles added to the first product are arrived at. *It seems to me that the gallons have been indiscriminately multiplied with cubic feet without any regard to candle power; yet the* 5,600,000 *are carried to the credit.* In B's calculation, the product of 27,200 × 105 ÷ 5 = 571,200 is correct, and indicates foot-candles; but B has evidently been led into error when he multiplies the 35,000 apocryphal feet of gas by the 160 gallons.

Further I stated:

I do not wish you to think for a moment that I endorse any of the calculations for cost, as I consider the statements upon which they are based could not be supported in practical working, and more especially would say that I have never seen such barefaced misuse of figures to give value to an invention as instanced in A's calculation.

My investigations go to prove that a fairly good class of mineral oil of a specific gravity of ·885, if burned to deletion in ordinary air without leaving any bye-products in the shape of residual oils, only yields 501,760 candles per ton; and it is apparent that, if distilled into gas, one could not get more. Indeed, the Peebles process only claims 422,400; whereas, assuming the oil in this case to be somewhere about ·885 specific gravity, then we have a total weight of oil of 3717 lbs., or, 1 ton 13 cwt. 21 lbs. And working this out on the Peebles basis, one should obtain from your 420 gallons of oil 700,920 foot-candles; whereas in the second problem the figures stated claim 3,177,000.

It amuses me to think that Dr. Dvorkovitz, with his advisers, after a period of three months for digesting their figures and my comments thereon, should only now be sufficiently competent to think they see a loophole out, and to say that my statements are "entirely wrong and misleading;" although it will be remarked that he has never for a moment attempted to controvert them, but suggests the calling in of another expert for the purpose.

It should be apparent to the humblest worker in the gas industry that if 1000 cubic feet of nominal 16-candle gas cost 16d., 1000 candle-feet, or foot-candles, will cost, not 1d., but 5d.

$$\frac{1000 \times 16}{5} = 3200$$

Therefore 3200 foot-candles cost 16d., and 1000 foot-candles cost 5d.

$$\frac{1000 \times 16}{3200} = 5d.$$

The onus, therefore, is on Dr. Dvorkovitz to substantiate his figures of 8,456,000 foot-candles as the product in illuminating power of his 400 gallons of oil.

Does he still mean to say that he can supply 1000 foot-candles for 0·25d., or, in other words, supply a gas company with 16 candles' enrichment for 0·8d. per 1000 cubic feet?

Old Queen Street, S.W., Sept. 27, 1895. FRANK WRIGHT.

[As mentioned last week, the above letter came to hand too late to appear in our issue of the 1st inst. Other letters bearing upon the subject dealt with will be found in our "Miscellaneous" columns to-day. —ED. J.G.L.]

* The figures referred to are marked with an asterisk in above calculation.

LEGAL INTELLIGENCE.

Conviction of a Gas Collector for Embezzlement.

At the Marylebone Police Court last Thursday, Thomas C. Lovett was charged on remand with embezzling and stealing various sums of money, amounting to £78, belonging to The Gaslight and Coke Company. The facts were given in the JOURNAL last week (p. 677). Mr. R. Humphreys again prosecuted; Mr. Muskett defended. Three cases having been gone into, Mr. Muskett said his client pleaded guilty to the charge. The prisoner's case was a very sad one. He had married a widow in poor circumstances with three children; but at that time he was in receipt of only £85 a year, and this not being sufficient to maintain them, they were obliged to enter the Spalding Union. Upon being promoted, however, to the post of collector, he brought them to London, only to find later on that he was unable, even with a salary of £150, to meet his extra expenses. It was then that he had recourse to his employers' money. When his dishonesty was discovered, he made his way into Lincolnshire, and, failing to borrow the amount he had embezzled, he sold up his house in London, and took a small place at Gosberton, where he maintained himself—his wife and her children having again entered the Union—by working in the fields as a common labourer. Mr. Curtis Bennett, having regard to the fact that the prosecutors did not wish to press the case, sentenced the prisoner to six months' hard labour.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

The Ordinary Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. J. BLACKET GILL in the chair.

The SECRETARY (Mr. H. D. Ellis) having read the notice calling the meeting, the Directors' report and the statement of accounts, which were published in our last issue, were taken as read.

The CHAIRMAN said he did not think he need detain the proprietors at any length; for the half year had been a somewhat uneventful one—not that they were sorry for that—and the history of the Company was really before them in the report and accounts. From these, the proprietors would learn that for coal £6835 more had been spent than in the corresponding period of last year. They had received an additional £4797 for gas. This was an increase of about 7 per cent., which he thought must be regarded as very satisfactory. When he told them that their large neighbour was somewhat under this figure, he thought it spoke very well for the Commercial Company. The increase of the South Metropolitan Company was considerably more; but, as the proprietors were aware, their district was far better than the East-end. Stove and meter rentals were £318 more; and there was an increase of £1400 on tar. But residuals generally had not served them very well; for he found they had obtained £3938 less for coke, and £5344 less for sulphate of ammonia. The total receipts for residuals showed a difference of £7883 between this and the corresponding period of last year. As to sulphate of ammonia, the trade had been in an extraordinarily dull condition for some months; but those who knew something about the business, told them there was a prospect of revival. A quantity of sulphate was sent abroad—largely to Germany. It was used for the cultivation of beet-root; and he was told that the trade was not in a good condition. They were, he supposed, suffering there, as in this country, from great depression; but still the Directors hoped that this important product would command a good price in the market before long. Rates and taxes had a happy knack of increasing; and they were, on this occasion, £425 more. They had now touched something like 8s. 2d. in the pound, which was a very serious demand upon the Company; but they had to pay them, and look pleasant. The profit of the half year was £5857 less; but they were able to take £48,680 to profit and loss, which was within a very small amount (some £70 or £80) sufficient to pay the same dividend as before—viz., 13½ and 10½ per cent. respectively on the old and new stocks. Inasmuch as they were entitled to receive, under the sliding-scale, ¼ per cent. more dividend, the Directors proposed to take this ¼ per cent. from the balance of undivided profits, and add it to the reserve fund; and he was quite sure the proprietors would approve of this course. Regarding gas-stoves, they had a further 255 out in the district, making a total of 4810. As to incandescent gas lighting, it had been employed in Poplar for some time; and now certain streets in Whitechapel were to be lighted by means of the new burner. The Company did not push this system, though they were pleased to see it used in place of electricity; and he had no doubt it would be a useful handmaid to gas. Perhaps their most pleasing feature was the constant increase of prepayment meters. They had now 2118 in the district, which meant an increase of something like 548 since the last meeting. He had no doubt that some of the proprietors had seen that there had been a deputation to the Home Secretary, requesting him to appoint a Select Committee to inquire into the best method of preventing the frequent accidents which occurred through petroleum lamps. In his (the Chairman's) opinion, there was no need for a Select Committee; and the Home Secretary might have told the deputation that all that had to be done was simply to get a coin gas-meter, and so obtain for a penny a light for six hours. And what could be cheaper or safer? It appeared to him (the Chairman) that the matter was entirely in the hands of the public. Some people had a fancy, which they knew was as changeable as a fickle goddess; and possibly coin meters would go out of fashion. But he did not think so. He believed gas companies would find these meters a great boon; and he thought it was their duty to make known their usefulness wherever they could. The profit per meter was cut very fine; but if they made a small profit on one meter, and they had a number in use, the total profit reached a satisfactory amount. By means of these meters, they had got together a fresh class of consumers in the poorer districts; and they appeared to be a great boon. The British working man was rather slow in taking to some of these ideas; and he went on

in the same jog-trot kind of way. It struck him (the Chairman) that gas companies would have to do what Lord Sherbrooke said would have to be done when the franchise was lowered—that was, "educate our masters." They would have to educate the public, and show them the advantages that were to be derived by procuring a supply of gas through a coin meter. He did not think there was anything more for him to dwell upon in connection with the report and accounts; but he might say, as to the future, that he thought it was fairly satisfactory. The Directors had made coal contracts for the ensuing year at a low price—in one respect almost as low as they had ever made them at. This spoke very well for them, though he did not think it spoke so well for the trade of the country. The Company were also to the fore with a small amount of capital per ton of coal carbonized. It was less than any other Company—either London or Suburban—with one solitary exception. This was a source of great strength to them, and was a matter upon which they might congratulate themselves. The capital now averaged £420 per million cubic feet, as against £440 last year. The works were all in thoroughly good order. They had been laying out a considerable sum of money at Wapping, which was their best station for working; and there they were building a new retort-house, with many modern improvements. Their workpeople were, he believed, contented, as they ought to be; and he saw no reason why the Directors should not have as good an account to lay before the proprietors for the current half year as they had had for the past half year. He then moved the adoption of the report and accounts.

Mr. T. Bevan seconded the motion.

Mr. E. T. E. Besley, Q.C., thought there ought to be some expression of congratulation from the shareholders upon the state of the accounts. The Directors were not proposing to divide to the fullest extent the amount to which the proprietors were entitled, but recommended that ¼ per cent. should be carried to the reserve fund. If the Chairman could tell them the total sum that would go to the reserve fund, the matter would be more easily understood. It would also be interesting if they knew the maximum amount at which the reserve fund had stood in former years. He believed it had been reduced in bad times; and if the proprietors had this information, they would be able to estimate the time during which they would have to forego a portion of the dividend to which they were entitled to make the reserve fund equivalent to what it had been in past years. The best testimonial to the Directors was the price at which the stock stood in the Stock Exchange "Official List," because it showed the thorough confidence of the public in their management.

Mr. G. Ennis said he saw by the balance-sheet, under "Stores in hand," that tar, sulphate, and ammoniacal liquor were calculated at £21,799. He wanted to know whether the proprietors might assume that the valuation of sulphate had been taken at the present price, and not at any abnormal rate that might have been ruling during the half year. He also asked whether the Directors had taken any steps to dispose of it. In the profit and loss account, there was an item of £637 for income-tax. Of course, this was not the income-tax on the dividend; and he should like to know whether it arose from any ingenuity on the part or the Commissioners of Inland Revenue.

Mr. Simpson Rostron endorsed Mr. Besley's remarks as to the satisfactory nature of the accounts, and the prosperous position of the Company. In regard to coin meters, he could support the Chairman's remarks; and he thought they need be under no apprehension as to these meters going out of use. One curious result observed in South London (and possibly it had been noticed in the East-end) was that a number of the quarterly consumers had asked to have their ordinary meters replaced by coin meters. He was glad to see, though some shareholders might view it in a different light, that the Directors were not proposing to raise more capital. The exceptional powers possessed by the Company were not without a drawback, because they had to raise capital at a high rate of interest.

Mr. Gellett said the Company's stock was quoted at 305 to 310; and he asked whether any transfers had taken place at this price.

The Chairman, in answer to Mr. Besley, said the amount they put aside for the reserve fund was ¼ per cent., which was equal to £1787 a year; and as the reserve fund had stood as high as £44,000, it would take two-and-a-half years, putting by ¼ per cent., to bring it up to that figure. Some years ago, when the Company were not in such a happy position as now, and they had to draw large sums to assist in paying the dividends, the proprietors would remember that these sums came from undivided profits; and they had not to encroach on the invested reserve fund. Then regarding the question as to income-tax, it was simply put in the statement of profit and loss instead of another part of the accounts; and it represented income-tax on the surplus profits of the preceding year. As to the stock of sulphate question, the Engineer assured him that all the values were taken at the lowest current rate. Of course, this was a serious question for the Company; and the Directors always dealt with these matters from a business point of view, and would take the earliest possible opportunity of selling the sulphate at a fair and reasonable figure. Respecting the price of the stock, the Secretary informed him that the highest figure on a transfer was about 304; but the books had been closed during the past fortnight, and no transfers had been made since the last rise. As to Mr. Rostron's remarks, they did find that some consumers preferred the penny-in-the-slot system; but the Directors would rather keep them as ordinary consumers.

The motion was unanimously carried.

The dividends recommended having been declared,

On the motion of Mr. Besley, seconded by Mr. Ennis, the Chairman and Directors were thanked for the satisfactory way in which they had managed the affairs of the Company during the half year.

The Chairman acknowledged this mark of confidence; and, continuing, he proposed a vote of thanks to the Engineer, the Secretary, and the other officials. He observed that, of course, the "burden and heat of the day" fell upon Mr. Jones; and, in the past half year, he had perhaps had rather more than usual to contend with in the troublesome matter of the quinquennial assessment of the rates. This was a very heart-breaking business, as the rates always exhibited a tendency to increase; but the matter could not be in safer hands than those of Mr. Jones, as he was a perfect master of the subject. As to Mr. Ellis, he was always to the fore in doing everything well, and in a most effective manner.

Mr. Cecil seconded the motion, which was carried.

Mr. Jones, in responding, remarked that the Chairman had referred to some of his duties in connection with the rates. He (Mr. Jones) thought the shareholders would sympathize with the position which they were in in the East of London, in which poor district the rates were rising as though it was a rich one. The average rates five years ago were 6s. in the pound; but in one district they had now risen to 8s. 2d., and in another to 7s. 11d. The last Assessment Committee he had to visit, he found installed, instead of in the old Union workhouse, in a perfect palace, the building of which, he ventured to say, having knowledge of the state of trade in the East of London, ought never to have been undertaken. Last year, the Company were doing handsomely; but this year down had come sulphate of ammonia. With regard to the comforting views of the position, the incandescent light seemed to be fighting against the upper class of competition; while coin meters were fighting the lower class. Those who had been buying oil were now purchasing gas; and those who had been using electricity were also turning to gas. They were getting a hold at both ends of the string. They had always had a grip on the commercial or mercantile lighting; but on the luxurious and democratic lighting, they were now getting a grip. With regard to coin meters, they could not keep pace with them at present, notwithstanding that they had made increased provision for dealing with them. Although they could not show the enormous increase that obtained with other companies in more prosperous districts, they had plenty of work before them; and he believed, in a few years, they would be able to point to a large number of these meters. There was an old saying about aiming at the pigeon and shooting the crow; but it seemed to him they had been aiming at the crow and shooting the pigeon. They found that quite a different class to the working man was asking for a supply through coin meters; as they had received requests from consumers to do away with the ordinary supply, and put them on the prepayment system.

Mr. Ellis also acknowledged the vote; and the proceedings then terminated.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday last week—Mr. Edward Fottrell, J.P., in the chair.

The Secretary and Manager (Mr. W. F. Cotton, J.P.) read the Directors' report, which, with the accounts, was noticed last week.

The Chairman, in moving the adoption of the report and accounts, said, were it not for the depressed state of the market for residual products, the accounts would have shown a more favourable appearance. In comparison with the same period of last year, there had been a falling off of £2174 in the receipts for residuals. However, there were signs of improvement in the trades in which these articles were utilized; and the Board had hopes that an improvement would take place. Regarding the gas made and consumed, there had been a fair increase. The amount received under this head was in excess by £5481. The working showed good results from the coal carbonized. The expenses on manufacture had been kept at a reasonable rate; and the Board looked forward to an increased consumption. They had entered into contracts for coal on favourable terms; and these would be in full operation next quarter. Under these circumstances, the Directors had resolved to reduce the price of gas 2d. per 1000 cubic feet over the whole of the gas limits, to take effect from the December quarter. It would be within the recollection of the shareholders that, at the time the Board were obliged to increase the price of gas, it was not so much in consequence of an advance in the price of coal; for at that time the Company had three years' contracts running at very low rates, of which the consumers obtained the benefit. The chief cause was due to the fact that they were obliged to adopt what was known as the eight-hour shift, and to raise the wages of a large number of the workmen; the result being that the wages account increased to the extent of £10,000 per annum. In addition, the price of cannel (of which the Company used about 20,000 tons per annum) increased to the extent of 10s. per ton; and, at the present time, it was about 5s. per ton in excess of what they formerly paid. He, as Chairman of the Rathmines Commissioners, had induced that body to try the incandescent gas-burner in the large lamp at the head of Rathmines. At many places he had seen these burners in use; and he noticed that further improvements were being made in the mantles. The system would, in a measure, place gas and electric light on a fair trial; and possibly gas might be in the ascendant.

Mr. Maurice Brooks, D.L., seconded the motion, which was adopted.

The Chairman next proposed that dividends at the rate of 10½ and 7½ per cent. per annum be declared on the old and new shares respectively.

Mr. D. Drummond seconded the proposition, which was carried.

Mr. Brunker asked whether the Company would identify themselves with the incandescent light.

The Chairman said that the Company would supply the gas; and the consumer could use which burner he liked.

Mr. Gill said as the Chairman had alluded to the trial of the incandescent burner in Rathmines, he might mention that he had recently been in Belgium; and he found one of the large cities there lighted with these burners. They were more brilliant-looking than the electric light in Dublin.

Mr. Brunker moved a vote of thanks to the Chairman, Directors, and Secretary. He said, as an Auditor of the Company, he had an intimate knowledge of the way the concern had progressed under the superintendence of the Chairman; and he thought they might congratulate themselves on having such a gentleman at the head of their affairs.

Sir George Owens seconded the motion, and said they ought to feel very much obliged to the Directors and to their invaluable Secretary.

The Chairman and Mr. Cotton having replied, the proceedings terminated.

THE GAS AGITATION AT LIVERPOOL.

The Illuminating Power Question—Proposed Competitive Gas Supply.

At the Meeting of the Liverpool City Council last Wednesday—the LORD MAYOR presiding—some important business connected with the gas lighting of the city was introduced by Alderman F. Smith on behalf of the Special Lighting Committee.

Alderman SMITH first proposed a resolution, relieving the City Engineer from all responsibility in connection with street lighting and the inspection of gas, appointing as Gas Inspector Mr. C. R. Bellamy, who has hitherto performed the duties of Assistant Inspector, at his present salary, and varying accordingly the resolution passed in 1890 appointing Mr. Boulnois as Gas Inspector. This, Alderman Smith explained, was caused by the extension of the city, and the necessity of taking up the lighting arrangements of the out-townships.

Mr. BROWNHILL seconded the proposition, which was agreed to.

Alderman SMITH, in submitting the report of the Special Lighting Committee on the illuminating power of the gas in various towns (which has already been referred to in the JOURNAL), said it would be seen that the average price of coal per ton paid by the corporations cited in the memorandum was 12s. 6d. The average price of coal in the case of gas companies was 12s. 3d.; whereas Liverpool, with its close proximity to the Wigan coal-fields, paid 20s. 7d. per ton. By coal he meant the inclusive term as it was used in the accounts of the companies—including the cost of carriage, of unloading, and all expenses of depositing on the works. They had been endeavouring to press this matter on the attention of the Gas Company ever since June last; but, so far, having only had with the Directors one interview of three-quarters of an hour's duration, they had not had sufficient opportunity to discuss the question. A communication had been received from Mr. Garnett, on behalf of the Company, stating that the figures published by the Committee would be immediately investigated. Under these circumstances, he had thought it right to bring the matter before the Council in the form of a special resolution. He was sorry they had not been able to supply in the memorandum any explanation from the Company of what Mr. Austin Taylor had very properly described as the phenomenal price Liverpool paid for coal. Another matter in regard to this report was the great waste of gas (30 per cent.) by the consumers through improper consumption. The public were constantly grumbling about the gas; but the fact was they were furnished with as rich gas as had ever been supplied by any other company. The gas was extremely good; and there was no reason whatever to complain of it. In regard to the cost of coal, he invited the attention of the Council to the recently published bluebook on the mineral statistics of the United Kingdom. The bluebook showed that the average price of coal at the pit mouth in 1894 was 6s. 7·43d.; and in 1893, 6s. 9·51d. But an increase of 2d. in the average price of coal certainly did not justify the Company in placing upon the consumers the burden of an increase of 4d. per 1000 cubic feet in the price of gas. The bluebook also showed the value of coal at the principal shipping ports since 1876, and proved that the highest price in Liverpool was reached in 1893, when it was 14s. 8d. This, however, included bunker coal, which was brought from South Wales by rail, and could hardly be compared with the gas coal brought from Wigan. Another point was that while coke, as he was informed, was sold in Liverpool for 11s. 8d. per ton, large quantities of it were disposed of elsewhere for a much less price. In a speech delivered in 1891, the Chairman of the Company (Mr. E. Lawrence) was reported to have said that 2d. per 1000 cubic feet in the price of gas was equal to something like £25,000. Therefore it appeared that at that time, when the Company had to face a deficit of £48,000, they raised the price 4d. per 1000 cubic feet; yet, now there was a saving of £60,000, they only reduced the price 2d., which did not seem to be at all satisfactory. He thought the Company ought to show more consideration for the interests of those who had helped them so materially in the past, and enabled them to attain their present prosperous condition.

The report was accepted.

Alderman SMITH next moved the following resolution, of which he had given notice: "That, in view of the high price paid for the coal, &c., used by the Liverpool United Gaslight Company, and the consequent high price of gas and coke, the Town Clerk be, and he is hereby, instructed to do all that is necessary to enable the Council to promote a Bill in the forthcoming session of Parliament, to obtain powers to establish and maintain a competitive gas supply, and that Standing Order No. 61 be suspended accordingly." He said he put this motion on the paper because they were not able to get any nearer to a solution of the questions between the Corporation and the Gas Company, except by putting that body into Parliament. The paid-up capital of the Company was under two millions; and their income for the year ending June 30, 1894, was £616,930, which was more than the Corporation spent upon the whole of their municipal government, except payment of interest. In Manchester, where the gas undertaking was owned by the Corporation, they were able not only to make a profit of £134,000, but to light the streets free, and to abolish meter-rents, and at the same time reduce the price of gas 3d. per 1000 cubic feet, and carry £54,000 to their general account. During the year 1894, the consumers in Manchester were charged 2s. 6d. per 1000 cubic feet, as against 3s. 4d. and 3s. in Liverpool. There was no reason why the Company, with its two millions of capital, and that mainly Liverpool money, should be allowed to handicap the trades to the extent of something like 1s. per 1000 cubic feet more than they need do. It might be asked, Why not buy them out? The reply was that the transaction with the Electric Lighting Company was not such as to encourage them to repeat it. He would refer to one point—although it was only a small one—as an instance of the management of the Company. For inspecting the lighting of the church clocks, the Corporation had paid the Company £40 a year; and when the Lighting Committee took over this work themselves, they found it had been so well attended to before that the saving in gas for part of one quarter was 56 per cent. in the case of St. Peter's clock, 76 per cent. in the case of St. Nicholas's, and over 80 per cent. in the case of St. Luke's. He was quite aware of the difficulties that might be suggested with regard to carrying out a competitive scheme; but he had in his possession an analysis by Mr. W. King, the Engineer of the Company, showing that gas from Wigan cannel had, when consumed through Sugg's patent steatite batswing burner, an illuminating power of 25·87 candles, or 5 candles more than the Liverpool supply. A sample of Orrell or Arley coal yielded gas that had an illuminating power of 18·3 candles. The former could be delivered at Garston at from 24s. to 25s. a ton; and the latter at from 10s. 6d. to 11s. a ton. The question was whether the Council were going to allow the Company to hold them in bondage not only in respect of the portion of the city now built upon, but of that other part which would soon be included in the city. The Lighting Committee had already carried on negotiations with the Company to reduce the illuminating power of the gas. They had one appointment; but owing to the holidays of the Engineer, the indisposition of the Chairman, and the holidays of the Secretary of the Company, they had been unable to get any nearer, or to fix any new appointment during the last three or four months. He thought this was an entirely unreasonable delay. It was only when the Secretary of the Company communicated to the Town Clerk that he had no present intention of making any further appointment, that he (Alderman Smith) put this motion on the Council summons. The price paid for coal and cannel was a matter which, as far as he was concerned, the Company only could explain. There was a difference of 4s. per ton in the prices paid by Manchester and by Liverpool for coal; and, on the amount of coal used, this meant something between £60,000 and £100,000 a year. Were they going to allow the Company to pay what was really their maximum dividend but which they had always taken to be their minimum dividend, and also to pay what price they liked for coal, without their taking any step whatever in the interests of the public? He would pass over the dereliction of duty on the part of the Company in not telling consumers how best to make use of the article they supplied; for anyone who had had experience of the autocrats of Duke Street knew perfectly well that the interests of the consumers had been treated in a very cool manner and oftentimes with a very high hand. He was perfectly aware of the length of arm and the strength with which the Company could act; but this ought not to deter the Council from adopting the resolution he now submitted, and thereby placing the new Council in a position of dealing with the matter should they think it desirable. They did not wish to do serious damage to the Company; but they wanted a cheaper supply of gas which would be beneficial alike to the shareholder, who would receive his dividend in the ordinary way, and to the consumer who would get a nearer approach to value for his money. They could borrow £2,000,000 of money for £50,000 a year; and were they going to pay the Company anything they liked without taking some step?

Mr. R. D. HOLT, in seconding the motion, said they were very much indebted to Alderman Smith for the trouble he had taken in the matter of the gas lighting of the city. He believed, if the Company would only get to work, they could produce gas at a very much lower rate than at present. They, however, had a monopoly, than which there was nothing more dangerous for a community. He was very warmly in favour of pressure being put upon the Company to consider the more economic production of gas; and, though they were a moribund Council, he did not think that they could do any better work at the closing of their term of office, than the bringing of such a motion as this before the town.

Mr. PURCELL considered the gas consumers had a grievance which ought to be redressed, and trusted that, unless the Gas Company were brought to their senses, the Council would go to Parliament, and, if necessary, have gas-works of their own, which could be managed for the benefit of the community.

Alderman RATHBONE and Mr. BALL also supported the motion, which was unanimously agreed to.

SALFORD CORPORATION GAS SUPPLY.

A Discount on Consumers' Accounts.

The following motion was proposed by the Chairman of the Gas Committee (Mr. Holland) at the meeting of the Salford Town Council last Wednesday: "That a discount of 2d. per 1000 cubic feet of gas be allowed to all customers, within and without the borough, who pay their gas bills within one month from the date of the delivery of the account." Mr. Holland explained that the step which it was proposed to take would cost the Gas Committee rather more than £8000 per annum. Large profits were made by the Committee last year; and it was thought that they were likely to be about equally large this year. This being so, it was felt that the consumers should benefit; and, by their present proposal, the Committee sought to put a premium on the prompt payment of accounts. It was sought, in fact, to make every man his own gas bill collector. The motion was seconded by Mr. Phillips. Mr. Linsley asked whether the £8000 was to be all lost, or whether it was proposed to reduce the number of collectors. Mr. Holland answered that the Committee were not blind to the possible effects of the proposal now submitted. Changes would no doubt come round; but it was not well to be over-precipitate. They did not yet know how many people would avail themselves of the allowance for prompt payment. Mr. Mandley, though not desirous of opposing the motion, inquired whether it might not be well to devote the £8000 a year to helping to remove the borough out of its present melancholy financial position rather than to the purpose contemplated. It seemed desirable to do everything possible to remove the financial pressure on the people. Mr. Luckman pointed out that the proposal really meant a reduction of 2d. per pound in the rates to people who paid their gas accounts promptly. Mr. Snape said the question was whether they could afford to present £8000 a year to the wealthy gas consumers. He feared that it was only the wealthy ones who would earn the discount. In six years' time, if they devoted the £8000 to the purpose, they would wipe out the deficiency of £50,000, and thus avoid the necessity of going to Parliament for the purpose. Mr. Yearnshaw disagreed with Mr. Snape as to the class of people who were likely to benefit by the allowance; and said he believed it was the poor people

who would chiefly reap the advantage. The Gas Committee hoped to make up the £8000 by means of the increased consumption of gas. Mr. Mansfield said it was not £50,000 that was wanted to make good the deficiency in the finances of the borough; considerable sums had to be deducted from that. At present the borough was under a cloud; and they knew what might happen if they went to Parliament. It would be better to work along quietly for two or three years, and keep trying to right themselves. The motion was carried.

THE BOLTON CORPORATION AND THEIR GAS STOKERS.

Alleged Breach of Faith by the Men.

At the Meeting of the Bolton Town Council last Wednesday, a discussion took place with regard to the recent dispute between the Gas Committee and the stokers at the Lum Street works. The matter was introduced by Mr. Battle, a labour representative; and he asked the Chairman of the Gas Committee for an explanation of the affair. The Town Clerk, at the request of Alderman Miles, the Chairman of the Committee, read a communication which had been received from the Secretary to the Bolton and District Gas Workers' Association. This document set forth that the stokers at the Lum Street works had unanimously decided that they could not carbonize 3 tons 12 cwt., and that they declined to return the extra pay they had been receiving in accordance with an arrangement made last April. Upon this the Gas Committee passed a resolution regretting the action taken by the men, and expressing the opinion that the refusal to refund the additional wages was a breach of faith. Mr. Battle declared that the stokers performed an amount of work which justified the payment they had received, and yet, because they did not agree to the suggestion sent forth some time ago as to carrying out certain conditions, they were required to pay back the extra money they had had. He thought the "game" was scarcely "worth the candle." Mr. Tootill (the Secretary to the Bolton Trades Council) disagreed with the last speaker, and argued that the men had not treated the Corporation honourably. He reminded the Council that the men voluntarily offered the conditions to which they objected in their letter. Mr. A. H. Taylor did not think the Committee were right in asking the men to refund the money they had got. Mr. Kearsley remarked that the men first approached the Committee, and offered, in the event of the Committee giving additional remuneration for Sunday labour, to carbonize 3 tons 12 cwt. instead of 3 tons 8 cwt. of coal. Failing their being able to carbonize the additional coal, the men arranged to refund the extra money paid them. Alderman Miles, replying upon the discussion, said that prior to last April the men asked that double time should be paid for Sunday labour to all employees at the gas-works. Hitherto they had been paying time-and-a-half for two shifts on Sundays. As the result of negotiations, the Committee said they would be willing to pay time-and-a-half for the three Sunday shifts, if the men would carbonize a little extra weight of coal—the quantity fixed being 3 tons 12 cwt. instead of 3 tons 8 cwt. This last, he added, had been a bugbear to the management of the Gas Department ever since it was introduced, simply because it was considered that this quantity did not represent, under the conditions prevailing, a fair day's work per man. It had also the effect of not enabling the Lum Street station to turn out the work of which the plant was capable. The men agreed to the conditions of the Committee, and an arrangement was entered into whereby the men were to receive time-and-a-half for all three Sunday shifts from April 4 to Aug. 1, when the men would commence to carbonize the extra quantity of coal. Not a pennyworth of extra work was done between those dates by the men; and when, on the 1st of August, they were asked to carbonize the 3 tons 12 cwt., one shift tried, and then reported that it could not be done. He believed that it was never intended to be done, and that the men did not try. The men had received in the aggregate something like £50 extra between the dates given; and in the opinion of the Committee, the men did not give the new arrangement an honest trial, and, according to promise, they should have returned the £50. In his opinion, the men had been guilty of a breach of faith; and this winter the Gas Department would be placed in the position of having a large number of retorts not being allowed to carbonize the quantity of coal they were capable of doing. He said publicly that it would be unwise to risk any complications with labour at the gas-works at this time of the year; but the Council and the public would readily see what this action on the part of the men would lead to. He was of opinion that they had made a great mistake in their present action. Before concluding, he intimated that the question of mechanical stoking, which was deferred owing to the promises made by the men, would have to be considered at an early date.

Bathing in Water Reservoirs.—At the Waltham Abbey Petty Sessions last Tuesday, an application was made by Mr. G. Kebbell, on behalf of the East London Water Company, for process against certain persons who had been found bathing in the Company's reservoirs. Mr. Kebbell said it was a serious matter for both the consumers and the Company; and the latter were desirous that it should be known that such bathing, which had become very common during the hot weather, was, by statute, a criminal offence. The application was granted.

Uxbridge Water Supply.—The Uxbridge District Council have resolved to obtain the opinion of an expert as to the best means of providing a constant service of water to the town. This step, however, will not be taken until negotiations are completed for wells on premises owned by Messrs. Stagg, which are capable of yielding some 1800 to 2000 gallons of water per hour. The supply of the town has for some time past been deficient; and this auxiliary source would put the Council in the same position as they were in two or three years ago, and give the consumers 20 gallons per head per day. But this is only regarded as a temporary measure. That the Council should now seek an additional permanent source is shown by a statement by the Surveyor (Mr. Eves) that two years ago they pumped 185,000 gallons per day; but now they are only obtaining 145,000 gallons.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

Mr. Lewis T. Wright asks us to publish the following letter, which he has addressed to Mr. W. C. Dixon, the Chairman of the Gas Committee of the Bradford Corporation:—

Oct. 2, 1895.

Sir,—The publicity that has been given to all kinds of reports, documents, &c., relating to the above process, the rumours and erroneous statements that have appeared in various newspapers from time to time—and even during the course of the actual experiments, when good sense, fair play, and etiquette demanded that silence should be observed, at least until the result was known to the gentleman engaged by the Corporation to conduct the inquiry—and the attacks made upon myself, compel me to break the silence that, under ordinary circumstances, it would be my duty to observe.

The real matter that was technically at stake—the real issue that had to be threshed out—is left in the background by those who have been busy in publishing information that I shall be able to show contradicts itself. In now answering the attacks and criticisms that were made upon me at a time when my mouth was closed, I find myself in the agreeable position of being able to refute my opponents by means of their own words—so much have they contradicted themselves and each other. It is impossible to shake their printed matter over my office table without their contradictions rattling down on the paper on which I now write.

It will be remembered that, when the Gas Committee invited me to examine and report on the process in question, I made it a condition that I should have liberty to apply the tests I thought proper, and that the plant should be run by the inventor.

On the commencement of the first trial, in addition to the inventor, many other persons were assembled—including the Messrs. Newbigging, of whose intended presence in the affair no notice had been given to me. By the contract with the Corporation, Mr. Smith was entitled to a representative. He brought several. You wished to clear the works in order that the trial might begin; and as it was my opinion that he ought to have all the technical advice he might need (other than that of the officials of the Corporation, and my own had he required it) in showing off to the best possible advantage all the advantages of his process, I intervened, and said that I would have much pleasure in meeting Mr. Newbigging in connection with the affair. Thus it happened that Mr. Newbigging was present during the whole of the first and abortive trial. The trial was suddenly stopped by Dr. Dvorkovitz, with his own hands; and I was compelled to retire.

This incident threatened to result prejudicially to the owners of the process. It was, however, amicably arranged that there should be another trial, and that Mr. Smith should be represented by "Mr. Newbigging." On the commencement of the new trial, Mr. Newbigging, jun., presented himself, and explained that he was the Mr. Newbigging under the terms of the Gas Committee's permission, and asked me if I would have any objection if his father came over occasionally. My reply was, as on the previous occasion, that I would have great pleasure in meeting him.

In order to avoid the recurrence of the wild and irresponsible rumours that were carried out of the works during the first trial, I requested that Mr. Newbigging, jun., should refrain from expressing any opinion of the result until it was definitely known. After the result was known, he was free to say what it best pleased him to inform his client.

The process, as I saw it at the Thornton Road works, consists of two parts—viz., the retorting process and the carburetting apparatus. This latter part has since been disowned by Mr. Shaw.* I found that the oil gas had an enriching value of 1139 candles per gallon of oil passed through the retorts, or 1753 candles per gallon actually gasified (Mr. Newbigging, jun., gave it a value of nearly 1 per cent. more). The result given by good lamps, the wicks of which are not less perfect gas-works than an oil-gas process, is about 1400 to 1700 candles. The result, as judged by the direct combustion of petroleum in good lamps, would be favourable if the process could gasify the whole of the oil instead of gasifying but (as I have mentioned in my report) from 40 to 65 per cent. of the oil. The American carburetted water-gas plants give about 1200 candles, with a gasification of from 85 to 90 per cent. of the oil. This higher result of the Dvorkovitz process is due to the result having been the enriching value, and not the "naked" or *per se* value, as stated in my report. The result, so far as the oil-gas alone is concerned, is good, though not so high as was promised by the inventor in his letter of July 4, 1894. It will be observed that in those days Dr. Dvorkovitz had not adopted the candles used by Mr. C. Wood, but those as used by myself. He promised 105 cubic feet of 57½-candle power gas per gallon of oil retorted. This calculation is evidently $\frac{105 \times 57\frac{1}{2}}{5} = 1207\frac{1}{2}$ (1210 rounded off). The difference between his promise and what I found for the oil gas is not of any moment.

Mr. Newbigging, jun., has confirmed my tests. When, as the average of the three days' test, I found a difference due to the enrichment of the oil gas of 1·91, he gives 1·93. On the 27th of July, 1895, Mr. Newbigging, sen., writes: "My son has shown me the results of the tests. I am glad that yours and his agree so well. It is highly satisfactory." This proves that there is no ground for complaint about the oil-gas test.

Of quite different character is the result obtained with the carburettor—a subject that Messrs. Newbigging have not mentioned in their reports. On the 20th of last month [September], Dr. Dvorkovitz, in a letter to the JOURNAL OF GAS LIGHTING, declares I ought to have tried the carburettor as he wished in accordance with the thirty-three days' test, which he insists is correct; but on the same day Mr. Shaw writes that the carburettor is not part of their oil plant, but a suggestion of the Corporation's Engineer.

Dr. Dvorkovitz commenced in July, 1894, with his candle values in order. On the 1st of April, 1895, his candles are five times too

* See JOURNAL, Oct. 1, p. 680.

numerous, because he no longer divides the product of cubic feet and illuminating power by 5, as is correct to do, in order to bring that product into candles.

It was found, in the course of trials with the carburettor (repudiated by Mr. Shaw on the same day when Dr. Dvorkovitz treats it as an essential part of his process), that the oil-gas tar had an enriching value of 35,000 candles (*vide* Mr. Wood's report of the 23rd of January, 1895).* This high quantity must be divided by 5 to bring Mr. Wood's candles to the correct ones and to those employed by the inventor in 1894. In the carburetting, the whole of the tar is not evaporated into the gas; and it has never been claimed that more than a portion can be so evaporated. From the book of the carburetting trials, it would appear that the enriching value of the portion so evaporated has reached 350,000 feet-candles per gallon. These enormous values are the cause of the wrangling spoken of by Mr. Newbigging, and not the discussion about the figure 5 that excites their ridicule. It was no question of 5, but of 100. It was easy to see by an inspection of the various reports that two different candle-values had been employed.

In the presence of the representatives of Mr. Smith, I made a test, which, in my opinion, is the most favourable to the oil-gas tar that could be designed. It is described in my report. This gave 1550 candles per gallon of oil evaporated. Mr. Newbigging, jun., after consultation with the official in charge of the works, asked to have a test made on the lines of the previous carburetting tests. I consented, of course. The result was much lower than that I had obtained; and I did not make use of it in my calculations. Messrs. Newbigging have adopted as a method of valuation of the oil-gas tar its analysis.

How does it happen that Messrs. Newbigging, who have confronted me, as I will show, with all sorts of irrelevant matters that have not even a remote relation with the subject under discussion, have not produced the evidence, not of the carburetting experiment made by the request of Mr. Newbigging, jun., but that afforded by Mr. Wood's results? They have found no difficulty in digesting the candles that are five times too high. They say in their report of the 6th of August, 1895, that generally their results bear out those obtained by Mr. Wood. The basis they have chosen is an analysis of the tar—an analysis that I do not think they understand. The analysis shows that the tar has been separated into four crude products—viz., a crude naphtha 54/91, which they called benzol, and value at 11d. per gallon; a light oil, at 11d.; a heavy oil, at 3d.; and a pitch, at 2d. per gallon. The pitch has no agglomerating properties; and, in a recent letter, they say that an allowance has been made for cost of distillation by taking something lower than the current rates on the secondary products. I must say that I see no evidence of any allowance having been made; and even if the 54/91 benzol could be properly described at all as 90 per cent. benzol, Messrs. Newbigging must have a vague notion of distilling and refining tar if they think ½d. per gallon will cover those expenses, and the cost of casks and carriage to port of shipment, &c.

I now come to Mr. Wood's letter of Sept. 3.† I may say that the Mr. Wood I refer to is, in every case, not the Mr. Wood who signs the reports and the letters relating to the matter in question, but Mr. Charles Wood. Mr. Wood commences by opening an attack upon me. It appears that, in April of this year, a gentleman in Bradford wrote to me about certain calculations which he described under A and B. I had not the faintest idea that they were related to the Bradford Corporation, or that the calculations that were wrong could have been made by anyone connected with the gas-works; and I was astonished afterwards to learn that they were Mr. Charles Wood's. I constantly receive such letters, asking me about matters relating to gas and the distillation of coal. There was nothing in the letter to indicate that it referred to any actual case. Mr. Charles Wood says that the chief difference between my estimate of 0·76d. per 200 candles and his of 0·42d. per 1000 feet-candles (which he, no doubt, means also to be 200 candles) is due to the different values given to the bye-products. Mr. Wood's 1000 feet-candles, or his candle-thousand, is, according to my way of thinking, 200 candles; and now that I know that it is 200 candles, I certainly decline to take him literally. If, however, he insists that I do take him literally, then his costs must be inevitably multiplied five times. As a fact, the main difference is due to the value given to the bye-products. I do not, however, think that anything is gained by calling this tar bye-products. The term appears to me quite unnecessary, as the material is known already as oil-gas tar. The letter I refer to is dated the 3rd of September, is addressed to the Gas Committee, and is published in the *Bradford Observer* of the 5th of September. In that letter he refers to the price offered by the Syndicate, of 6d. per gallon. This offer, which I have never seen in writing, I was told, was not an offer without conditions. One of the conditions was the right of supplying the oil at 4d. per gallon; and Mr. C. Wood can hardly have forgotten that, at a previous meeting, the offer for the oil-gas tar had been reduced by a gentleman, speaking with some appearance of authority, to 3½d. This probably refers to the 3½d. spoken of by Mr. Shaw (*Bradford Observer*, Sept. 21). I never had any offer put before me that I could advise the Corporation to accept, nor did I have more than a hearsay report that such an offer had been made or would be; and I gave everybody to understand clearly that I would advise the Corporation to reject any offer that was not quite free from all conditions. It would be reckless for a corporation to enter into a contract for a gas-enriching process that was to give a certain quality and quantity of tar. They would always have hanging over them the fear that a deviation from what the inventor might say was his process, would leave them in the position of having the tar left on their hands. This is especially the danger in this process, wherein it is claimed that all the merit depends upon the degree of temperature employed; and there is not provided any automatic arrangement for the control of that temperature. It is a question of skill; and no inventor, when he sells his plant and leaves it, can leave his skill behind him. A slight increase of temperature, and the tar thickens; and on a decrease of temperature, the tar thins. The Corporation require oil-gas enrichment and not bye-products to sell. If anything went wrong with the oil gas, the Corporation would say that it was due to the quality of the oil supplied; if anything went wrong with the bye-products, the contractors would say the process was not being worked in accordance with the intention of the inventor.

Mr. Wood complains that, in my experiment, the bye-products were distilled too rapidly. I ask if it is now worth while to reopen this question of the carburettor? If Mr. Wood feels that he must still insist upon his ability to extract 350,000 feet-candles from a gallon of oil vaporized, or that the whole bulk of the tar is worth 35,000 candles per gallon (*vide* report of March 28*), then I must discuss the matter on the basis of his carburettor book. I was not aware until my report had been published, that the carburettor I found in the Thornton Road works, and in connection with which Dr. Dvorkovitz protested (*vide* his letter of Sept. 20 to the JOURNAL OF GAS LIGHTING), because I declined to test it in conjunction with the oil-gas plant, until I had time to apply a test for permanency, would be afterwards disowned by Mr. Shaw.

When Mr. Wood criticizes my cannel estimate, he must not be surprised if I reply with some detail. He has found it necessary to change his opinions on this subject from time to time. On the 2nd of July, 1894, he is of the opinion that cannel is likely to be reduced in the future considerably under 1¼d. per candle per 1000 cubic feet (200 candles); and he is now surprised that I should arrive at a cost of 0·81d. I would further point out to him that, on the 28th of March, 1895, he informed the Committee that the cost was then 0·79d. But I will show, if the returns he himself is responsible for are used as evidence, that the cost of cannel enrichment must be very much lower than either his estimate of 0·79d. or mine of 0·81d. I find that the average illuminating power of the town gas at Bradford is 18·83 candles for the three years ending March, 1893. At Bradford, 25 per cent. of cannel is used to produce this quality. If we know the quality of the unenriched coal gas, then it is easy to arrive at the value of the cannel. The information we have on this subject is partly provided by Mr. Wood, partly by Mr. Newbigging, and partly by myself. I will give the results together with the enriching value of the cannel. They show, if the quality of the gas as supplied to the town is 18·83 candles, the following enriching values:—

	Value of Common Coal Gas.	Enriching Value of Cannel Gas.
Thirty-three days' test oil gas (Mr. Wood)	15·16 candles.	.. 29·8 candles.
Report of March 28, 1895 (Mr. Wood)	15·67 ,,	.. 28·3 ,,
,, ,, ,,	15·75 ,,	.. 28·1 ,,

So that the enriching value of the cannel would be, according to Mr. Wood's reports, from 28·1 to 29·8 candles. Mr. Newbigging found the unenriched coal gas to be 15·7 candles; I found it to be 15·8 candles.

As regards the price, Mr. Wood asserts that, out of 500,000 tons offered, none came up to my estimate of 23 candles, at the price I take of 13s. per ton. The Committee has accepted tenders at prices of from 9s. 6d. to 15s., and that ostensibly for cannel that, by Mr. Wood's returns, must have, on an average, an enriching value of 28 to 30 candles. How is it that he can object to my taking 23 candles with cannel at 13s.?

With cannel of an enriching value of 28·7 candles, and costing but 13s. 3½d. per ton (the average price paid at Bradford), it will be necessary to show that the whole of the bye-products from the cannel coal are only worth 2s. per ton of cannel carbonized before a fraction can be added to my estimate of 0·81d.; and with the lowest yields and prices that it would not be ludicrous to take, it is impossible for Mr. Charles Wood, in the face of his figures, to prove that cannel enrichment is costing more than 0·70d., as it will be to show what circumstances have happened since March 28, 1895, to justify his opinion expressed to the Committee that the cost is now over 1d., owing to the difficulty of disposing of the cannel coke.

The reason I do not adopt the figures that are the natural outcome of the information provided by Mr. Wood—figures that lead him fatally to a contradiction of his now estimate of over 1d.—is because I do not think the average cannel Bradford obtains at 13s. 3½d. per ton will have an enriching value of 28 to 30 candles. Messrs. Wood and Newbigging are astonished when I take it at 23 candles. Mr. Charles Wood cannot change his estimates in this manner. He says that gas liquor is only worth 7s. per ton according to the market quotation. Why does he refer to the JOURNAL OF GAS LIGHTING for market quotations, when he has sulphate works, and knows that he has obtained the following figures?

Year ended.	Average per Gallon of 10-oz. Liquor.
March, 1891	0·94d.
,, 1892	0·85d.
,, 1893	0·84d.

He objects to my having taken 0·84d. per gallon. How can he say, in the face of his figures, that cannel enrichment will cost more than my estimate? How can he explain why his estimate of 0·79d. should now be over 1d., as he stated to the Committee? It cannot be because, as he says, of the low price of cannel coke. I have taken that into account, in deference to his assurance that the cannel coke that has averaged for three years 6s. per ton is now almost unsaleable.

Messrs. Newbigging, in their letter of the 7th of September,† follow in the same strain. Their letter is the confused echo of Mr. Wood's. They are astonished at cannel of 23-candle enrichment at 13s. I ask them what they suppose the Bradford Corporation obtains for the cannel at 13s. 3½d., which I have shown to be the average price. They can make an estimate. They know something of the unenriched gas. Perhaps they will explain how it is that Bradford obtains 18·83-candle gas with 25 per cent. of cannel of less than 23-candle enriching power. They have already committed themselves in their report of the 6th of August, 1895,‡ to the statement that: (1) The average cost of cannel enrichment is 1¼d.; (2) that the cost at Bradford is less than 1¼d. due to exceptional circumstances. What are these exceptional circumstances? Is it that the cannel bought at 13s. 3½d. per ton is equal to an enriching value of 28 to 30 candles? This will not very well explain their surprise at my estimate of cannel at 13s. with 23 candles enriching value. Otherwise I deny that the circumstances at Bradford are exceptional. There are many towns in quite as favourable a position, and some in a more favourable position, as regards

* See JOURNAL for Feb. 12, p. 329. † *Ibid.*, Sept. 10, p. 542.

* See JOURNAL, Oct. 1, p. 679.

† *Ibid.*, Sept. 17, p. 590; also correction Sept. 24, p. 636. ‡ *Ibid.*, Oct. 1, p. 682.

cannel. Messrs. Newbigging's estimate of the average cost at 1¼d. does not, however, apply to Bradford, is really irrelevant, and I will not say anything more about it.

They state that, as a matter of fact, it is well known that the coke from many high-class cannels is absolutely worthless. What, I have asked, have high-class cannels to do with the case under discussion? Do they suppose that Bradford can obtain high-class cannels at 13s. 3½d. per ton, or that high-class cannels have (according to them) less than 23 candles enriching power? I fail to see how the remark is relevant, for several reasons—viz., that high-class cannels cost more than twice the price Bradford pays, and give gas of considerably more than 23 candles enriching power, and because it is also well known that some high-class cannels do give excellent coke.

What is the object of these irrelevant remarks? Messrs. Newbigging cannot pull my estimate down by such references. The quantity of tar Messrs. Newbigging must take my word for, since it is based upon my own results. If they knew much about—not high-class cannels, for these are not under discussion, but the second-class Midland cannels, as used at Bradford, they would know that there are such cannels that give more tar than I find as the average of the particular cannel I estimate for.

I insist on the integrity of my estimate for the cannel I select as my basis—a cannel selected because I could not accept the figures I found at Bradford so far as to adopt them as my own. That disposes of the alteration that has been made of my figures. I claim to have proved Messrs. Newbigging and Wood's objections are untenable.

Messrs. Newbigging say they differ from me on two vital points: (1) The price of the oil; (2) the value of the bye-products. In their report of Aug. 6, they say that the price they take, of 3½d. per gallon, is that on which the results of other enriching processes have been based. They now say, on the 7th of September: "We took the price at 3·25d. for the reason that the other oil actually used in the experiment was of inferior quality." Is it a coincidence that the price of inferior oil and that of oil used for obtaining results in other enriching processes is always 3½d. per gallon; or were all the other oils of inferior quality, and is the only oil of good quality that used in the thirty-three days' test? These two different statements require some explanation. Why did they, in their report of Aug. 6, not say at once that they took the price at 3½d. because the oil was of inferior quality? Why did they give another explanation then?

They, on Sept. 7, quote, in support of the new statement that they took the price at 3½d. because the oil was of inferior quality, a letter from Messrs. Besseler, Waechter, and Co. to the Town Clerk. This letter is dated July 31, stating that they are not at all surprised to learn that the waggon of oil was not so good as that used in the thirty-three days' test. The letter to which this is a reply was, I suppose, dated before the 31st of July. Before the 31st of July, neither I nor Messrs. Newbigging could have known, with any degree of certainty, that the oil was inferior to the thirty-three days' test, even if we had had any personal knowledge of that test. We were the only persons who were in possession of the information on which an opinion could be formed as to what was the quality of the oil we used; and we had not finished our reports. Mine is dated the 1st of August; and Messrs. Newbigging date theirs the 6th of August. And yet, before we knew the results, and when no one else could have known, there is correspondence being carried on behind my back prejudging the result, and condemning the oil.

The matter was put into my hands by the Gas Committee. That body never interfered with my action. The officials were not present during the whole of the testing, and could not therefore have known. Mr. Newbigging, jun., and I are the only parties who could have formed an opinion founded upon knowledge; and yet the matter is taken out of my hands before I know and before I report, and the oil is condemned. And more, when the correspondence comes to light, it does so in a letter written by the representative of Mr. Smith to Mr. Smith; and that letter is circulated among the members of the Council when they are going to discuss the question, and before I have time to point out what I am going to do. My report of the 1st of August is in manuscript, on the table of the Committee meeting of the 9th; whilst Messrs. Newbigging's report of the 6th is printed, and in the hands of the members of the Committee!

Is there any foundation for saying that the oil was bad? I see none; and I will refute the statement by a reference to Mr. Wood's own figures. I will show that his report of the thirty-three days' test disproves what Messrs. Newbigging, Dvorkovitz, and Shaw are urging—viz., that the oil of the recent test was inferior to that of the thirty-three days; or, in other words, that the Kerosene Company's "Solar oil" was inferior to the Nobel's. On the contrary, I will show that these figures, that the Committee is called upon to accept in preference to my test, lead them inevitably to the opposite conclusion.

In the thirty-three days' test, 1513 candles per gallon of oil passed through the retorts were obtained; *but at the same time* 0·0713 *of a gallon of bye-products—oil-gas tar—were employed (vide Mr. Wood's report of March* 28, 1895*) in carburetting in the carburettor*, now disowned by Mr. Shaw, and thrown back upon the Corporation's Engineer. Mr. Charles Wood insists, and has always insisted, on the very high values for this oil-gas tar; and this insistence is the cause, I believe, of the wrangling (*vide* your speech in the Council on the 10th of September). I will not refer to the figures in the carburetting report book, but to Mr. Wood's report of the 23rd of January, 1895, where he puts one gallon of bye-products (oil-gas tar) as equal to 35,000 candles. Of course, but a portion of this oil-gas tar can be evaporated into the gas; and the results, calculated on the oil vaporized, have, if my memory serves me correctly, reached 350,000 candles per gallon of oil vaporized in some cases. His candles are five times higher than mine. I therefore reduce his 35,000 candles per gallon of oil-gas tar to 7000. From the total of 1513 candles per gallon of oil in the 33 days' test must be deducted, for the oil-gas tar used in carburetting, 0·0713 × 7000 = 499 candles. Thus reducing the candles due to the 68·15 cubic feet of oil gas from the retorts to—

1513 candles from oil gas and carburettor.
Deduct 499 candles from carburettor.

Leaving 1014 candles of oil gas per 68·15 cubic feet.

I will now summarize the results for the oil gas alone without carburetting—

	Cubic Feet per Gallon.	Oil Gas Tar.	Candles per Gallon.	Candles per 5 Cub. Feet of Oil Gas.
My test.	69·70 ..	35·00 ..	1,139 ..	81·7
Thirty-three days' test	68·15 ..	37·31 ..	1,014 ..	73·3
Dvorkovitz's promise, July 1894 . . .	105·00 ..	37·50 ..	1,210 (?) ..	57·5

I now put the gentlemen who insist upon the superior quality of the oil used in the thirty-three days' test upon the horns of the following dilemma: They must either admit that the oil (Kerosene Company's) in the recent test is *superior* to the other, or they must deny the 35,000 candles given by Mr. Wood as the value of the bye-products (oil-gas tar). Is the particular lot of the Kerosene Company's oil to be condemned upon such evidence? I do not discuss whether one merchant is justified in thinking his geese to be swans; but we cannot allow such evidence to make us believe that the Kerosene Company's swans are geese.

As regards the bye-products, Messrs. Newbigging say that they gave 4·695d. per gallon as the value; and that their figures are unrefuted. Whose business was it to refute Messrs. Newbigging's figures? I had no interest in refuting their figures, especially as in this case it appears to me that the figures refute themselves. The Gas Committee had nothing to do with Messrs. Newbigging's report. I certainly was asked about the figures. But I would never have gone out of my way to make an observation about their figures if I had not been asked; nor would I do so now unless forced to do so by the manner in which they have criticized mine.

I am glad to see that Messrs. Newbigging are prepared for a reduction in the 4·659d. per gallon. They are mistaken entirely in saying that any blunder of mine is the cause of the wrangling; and they should have verified that statement before having made it. Messrs. Newbigging will discover, on inquiry, that the illuminating power of coal gas in this country is stated in candles per 5 cubic feet; and that when people speak of 15-candle gas, for example, that is only a ready and handy way of saying that 5 cubic feet are equal to 15 candles, and consequently that one cubic foot is equal to 3 candles. I do not see how Dr. Dvorkovitz can be an authority on this matter, since he commenced, in July, 1894, with candles similar to mine, and on the 1st of April, 1895, sets them five times too high in number. I have shown how he passed through a transition stage; and he is still not clear on the subject. I am informed by you that the cause of all the wrangling was that yourself and certain members of the Committee could not understand the extraordinarily high results given by Mr. Charles Wood. He was asked to look into them. It was discovered that the candles employed in July, 1894, by Dr. Dvorkovitz had become increased by five. A little goodwill would have explained the affair, and have prevented you and others from seeking to learn the truth about such matters outside.

The question of the price of oil—and I have shown that Messrs. Newbigging have made two different statements on the subject of their price of 3½d. per gallon that do not altogether coincide, especially when they are taken in conjunction with this correspondence about the inferior quality of the oil, that Mr. Wood's own figures disprove—is very simple. I wrote to the Town Clerk to ask the Committee to have prices obtained for the same or similar oil. The price furnished me by the Town Clerk was 3·8d. per gallon, including hire of tank-waggons. This price was slightly lower than one other quotation put before me, and the same, I understood, as a quotation previously made for a very large quantity. This disposes of the question of price, which was rumoured at first as being based on small quantities taken for experiment; later on as being that "on which the results of other enriching processes have been based;" and more recently as the price because it was of "inferior quality." I consider I have been able to dispose of all these contradictory statements.

It is complained that I did not take the best basis for the valuation of the bye-products (oil-gas tar). There were several open to discussion. Of those that were possible, I took that one most favourable to the oil gas. There were the following bases: (1) Its value as a fuel. This is less than ½d. per gallon at Bradford. (2) Its valuation for distillation. I do not see how the Corporation could be reasonably asked to enter into a gas-enrichment process that would entail the installation of a tar-distiller's business for the relatively small quantity of oil-gas tar to be distilled. (3) Its valuation on the basis of the conditional offer made by the Syndicate, reported in July to be 6d., and now 3½d. per gallon. I have already discussed this; and further say that, even had I been asked by the Committee to adopt this basis, I should have in my report declined all responsibility, and would have held out no hope that other persons not favoured with such an offer would be able, in the open market, to secure more than ¾d. per gallon.

I found for the portion of oil volatilized 1550 candles per gallon. Had we been enriching with pure benzol, instead of with crude tar, which there is every reason to suppose would exert a prejudicial effect, by absorbing some traces of hydrocarbons from the gas, we could not have obtained more than 1700 to 1800 candles.

Having thus replied in detail to all the criticisms that it has been thought convenient to launch at me, I now claim the right of asking for a clear answer to those I have advanced against my opponents' criticisms. How do Messrs. Newbigging explain their two statements respecting the price of oil—viz., 3½d. per gallon? The importance of this question they will not fail to recognize. How do they know that the oil was inferior? How do the people who claim that Mr. Wood's results must be accepted as final, explain that his figures prove that the oil must have been superior? How do Messrs. Newbigging explain their assertion that my way of stating results in candles is a "darkening of counsel," with pages 50 and 51 of their "Handbook," fifth edition, enlarged? In a future, and I suppose to be further enlarged, edition of that work will, I ask, Messrs. Newbigging retain the "precious 5" (to employ their own elegant style), or will they enlarge the number of candles, even at the cost of reducing the new edition by leaving out the "precious 5"?

Dr. Dvorkovitz succumbed to the hypnotic influence of the Bradford enlarged candles. The first mention of this change of ideas on the subject of candles, I find in a report purporting to be signed by him,

and dated the 1st of April, 1895.* When, may I ask, did Messrs. Newbigging change *their* opinion? I also ask them to justify their statement that I ever advised the Committee that Mr. Wood's figure of cost per candle was altogether wrong, and should be multiplied by five.

I am somewhat acquainted with Mr. W. Wood's reports, as also with those of Messrs. Newbigging; but I do not remember that Mr. Wood ever calculated his costs at per candle. I find that he calculates indifferently in "thousand feet-candles" or in "candle-thousands," which are, according to him, equivalent terms. I call upon Messrs. Newbigging to justify their statement about what they say I advised the Committee—a statement that I do not recognize as mine. Can they explain why they go back upon their "Handbook"? Has it anything to do with their statement—a statement that I deny—that my "blunder" was the cause of all the wrangling? How do Messrs. Newbigging explain their reference to high-class cannel?

How do the parties concerned explain the correspondence about the alleged inferiority of the oil used in the last test, which, by Mr. Wood's test, is proved to be superior? How do they explain why they take 23-candle (enriching) cannel at 14s. 6d. per ton, when Bradford figures (Mr. Wood's) show that he obtains 28 to 30 candles for 13s. 3½d.? How do they explain that on the 20th of September, 1895, the inventor is claiming the carburettor as an integral part of his invention, and on the same day Mr. Shaw is declaring it to be no part of their oil plant, but the suggestion of the Corporation Engineer? How do they explain that Mr. Shaw writes on the same day claiming that the thirty-six hour test was unfavourable because of the inferiority of the oil, "as notified at the time to the Town Clerk by the firm who supplied it," when, by the letter of Messrs. Newbigging of the 7th of September, it appears that it was the Town Clerk who notified the alleged inferiority of the oil to the firm in question?

How is it to be explained that Mr. Shaw writes at the same time, and, as another reason, that the unfavourable result is because of "the omission of any allowance for the value of the bye-products," and yet I had valued them in my estimate at 1·7d. per gallon? How is it explained that Dr. Dvorkovitz allows himself to say that my tests are not satisfactory; and yet they were confirmed in every particular by the representatives of Mr. Smith (*vide* Mr. Newbigging's letter, already quoted)? How do they account for the statement in the *Bradford Observer* that I had estimated the saving at £3125 when it was estimated at £942?

All these different statements, which appear to me to be very much ajar, may be good enough for the untechnical public. It remains to be seen if they can be explained in a manner satisfactory to those who understand the subject they relate to.

The case has its comic sides; but I make a point of asking Messrs. Newbigging to explain their two statements about the price of the oil in conjunction with the letter they publish from the firm that obtained it, as I understand (but I am open to correction), from the Kerosene Company.

It has been stated (Messrs. Newbigging have not stated it) that I said I would make no use of carburetting trials. I can dispose of this story at once. It is not true. Mr. Newbigging, jun., must have very strangely misunderstood his position in the matter if he supposed that he was entitled to make conditions with me. I was conducting the inquiry for the Corporation; and he was allowed to be present to watch all the tests I applied (I had liberty, by my arrangement with the Corporation, to apply all I thought proper), and he had equal facility given to him by me to make the same tests for himself. I never attempted to get between his proper judgment and his principals. Much less would I have allowed him or his father to do so with me. I never treated it as a matter for a collaboration of reports; and I could not understand what they had to do with my report, when they telegraphed on the 31st of July asking if I was sending in my report for the 2nd of August, and why Mr. Newbigging, sen., should require a meeting to agree upon certain matters of fact. The test had been made in the presence of the representative of the process. If the tests agreed, as they did, so much the better—there was so much less ground for debate; though even in this case of the tests which do agree (for the difference is less than 1 per cent.), Dr. Dvorkovitz is not satisfied.

A certain matter that happened revealed to me before the commencement of the second trial that an attempt might be made to put "Mr. Newbigging" in as collaborating with me against the orders and the meaning of the Committee, which were that I was to conduct a trial with the assistance of the officials of the Corporation, and that Mr. Newbigging should be allowed to represent Mr. Smith. I observed that, in an article in the *Bradford Observer* of Sept. 10, he is now promoted to the position of the "senior expert." I never permitted Mr. Newbigging, jun. (who cannot complain of the courtesy with which he was treated by me), to collaborate with me. The results he publishes are his; those I publish are mine.

The inventor endeavours to throw upon the Gas Committee the onus of proving the value of these bye-products (oil-gas tar). Does anyone know what that means? It means that an article, about which there is no published information on which a trade distilling value can be based, is part of their process; and the Committee is called upon to prove its value for distillation in the only way possible—by distilling it in a practical manner, and selling the products in the market in order to get them classed. This is a cool piece of business. Did it never occur to them that it was their duty to do this? Why should any Gas Committee be railed at because they have not proved that laboratory figures can be justified in practice, when the owners of the process are not able to show that they have made any serious attempt to provide the required proof? I am tired of pointing out these contradictions; but there are many other matters that have not escaped my attention.

LEWIS T. WRIGHT.

[By a slip of the pen, it was stated, in the lines introducing the documents on this subject which appeared in the JOURNAL last week, that Dr. Dvorkovitz had asked us to publish Mr. Lewis T. Wright's first report. As mentioned in the foot-note to Dr. Dvorkovitz's letter in the previous issue, it was Mr. Wood's report on the 33 days' test that he asked us to reproduce, with his reply thereto. This we did; and, in order to make the story complete as far as possible, we also gave Mr. Wright's first report. In Mr. Wright's letter of the 21st ult. to the Chairman of the Gas Committee, the date of the conclusion of the last trial is given as the 27th of July. The writer informs us that it should have been the 26th.—ED. J.G.L.]

Messrs. T. Newbigging and Son send us for publication the following letter in reply to that of Mr. Lewis T. Wright of the 21st ult., which appeared in the JOURNAL last week (p. 683):—

Sir,—We have read Mr. Lewis T. Wright's letter dated the 21st ult. [*ante*, p. 683], a portion of which purports to be a reply to ours of the 7th ult.

In a controversy of this kind, the resort to personalities should have been avoided. We regret, therefore, that Mr. Wright has endeavoured to institute a comparison between himself and us, to our disadvantage, on the question of fitness to deal with the matters at issue. In this connection, he trumpets his "twenty-three years' experience" in the use of cannel. This is the kind of boasting usually indulged in by disputants when worsted in argument. We say, in reply to Mr. Wright on this head, that if he will add nineteen years to his twenty-three, the sum-total will represent the duration of the experience of one of us with the same material; but that is neither here nor there. Whatever words have been bandied by others in a discussion which has caused a great deal of virulent writing and speaking, we at least have not hitherto questioned Mr. Wright's fitness to deal with the points in dispute; and it would have been only professional courtesy had he observed the same behaviour in regard to our qualifications.

Mr. Wright professes to have ascertained that the present Bradford contracts for cannel range from 9s. 6d. to 15s. per ton, and that the average is 13s. 3½d. Assume for the moment that this is so, what justification has Mr. Wright to offer for taking the price at 13s. in his estimate of the cost of enrichment by cannel? Further, why does Mr. Wright now abandon the claim for 19½ gallons of tar, which he assumed in his estimate would be the yield per ton—dismissing it with the remark that "it is too trifling to discuss"? The difference between a yield of 14 gallons (our figure) and 19½ gallons (his figure) is 28 per cent.; and this calculated out into money makes 10 per cent. on a reduction in the total money-value of all the residual products taken together, and at the prices assumed by Mr. Wright. Then as regards the ammoniacal liquor, his figure of value is equally absurd, as it represents the whole profit from the Chemical Department of the Corporation, which, among other things, includes the manufacture of sulphuric acid. These corrections made will materially raise his figure of cannel enrichment cost; and yet he has the temerity to assert that it is impossible to "affect his estimate by the one-hundredth part of a penny." But it is a thankless task attempting to follow Mr. Wright in all his sinuosities.

It is important to remember, in speaking of the price of cannel, that at the time when the introduction of the oil process was first entertained—viz., in 1893-4—the average price paid by the Bradford Corporation for cannel per ton was 17s. 8¾d. and 14s. 10½d. in those years respectively.

We agree with Mr. Wright that the real question at issue is not the cost of cannel enrichment, but the value of the bye-products from the oil process. It would have spared much unnecessary trouble had this occurred to him sooner. How has Mr. Wright arrived at his estimate of their value? By a brief test made in a carburettor, which is not a part of the Dvorkovitz apparatus, and which at the time of making the experiments we jointly condemned. We said at the time, and Mr. Wright fully agreed with us, that any conclusions drawn from its use during a brief experiment would be absolutely untrustworthy. In spite of this, he has based his estimate of the value of the bye-products on a three hours' test made with the carburettor, against which experiments there was a unanimous protest. Mr. Wright when at Bradford agreed to ignore these tests in making his report; but, instead of doing so, he has made strenuous use of them, to the disparagement of the oil process. Our value of them was arrived at from an analysis made by a competent and independent chemist. We embodied his analysis in our report; and we would refer those interested in the subject to the contents of that report.

The remainder of Mr. Wright's letter is taken up by an endeavour to show that we prejudged the case by making a statement about the quality of the oil, and that such statement was made without his authority. Had it been necessary, or had we desired, to make a statement, we did not require the authority of Mr. Wright for doing so. But we deny that we made any statement whatsoever until our report appeared. It shows the poverty of Mr. Wright's arguments when he attempts to make capital out of this. It was well known to everyone in any way connected with the experiments, that the oil used was inferior in quality. It was the only oil obtainable at the time. The matter was no secret. The firm who supplied it wished it to be clearly understood that the oil was inferior, and so informed the Town Clerk in a letter. Mr. Wright should be the last person to speak of prejudging the case, seeing he had expressed an opinion on the cost of enrichment by this process, basing his statement on Mr. Wood's figures, before being called in to examine and report on the process itself.

Mr. Wood is quite in order in his calculations in expressing the terms in "candle-thousands." This is a form of expression applied, as is well known, in many other departments of scientific inquiry; and it is a matter of surprise to us that such an elementary fact should need to be stated. Mr. Wright's proposed form of expression—viz., "the cost per thousand per candle per 5 cubic feet"—is both clumsy and unscientific. The 5 cubic feet as consumed in the standard test has no bearing whatever on the general question under discussion. When once the illuminating power has been ascertained, the 5 cubic feet drops out of consideration, because it is not a factor in the statement of the enrichment cost. This is only Mr. Wright's endeavour to give a colouring of justification to what follows.

Mr. Wood, the Gas Engineer of the Corporation, has pointed out in his letter of the 3rd ult. that on his calculations of the cost of enrichment by the process—viz., 0·42d. per thousand cubic feet—being submitted to Mr. Wright, the latter pronounced them to be incorrect,

* See JOURNAL, Oct. 1, p. 680.

and asserted that the figure of 0·42d. should be multiplied by 5, bringing up the cost to 2·1d. per 1000! This was a serious statement for Mr. Wright to make, because it has been a proximate cause of all the subsequent bickerings. If it had been true, it would have effectually undermined the professional reputation of the Corporation Gas Engineer, and jeopardized his position. Being incorrect, it recoils on Mr. Wright himself; and as he has not had the manliness to apologize for his initial blunder, his action, both in this instance and subsequently, may be left to the judgment of unbiassed readers.—We are, &c.,

THOMAS NEWBIGGING AND SON.

5, Norfolk Street, Manchester,
Oct. 2, 1895.

ELECTRIC LIGHTING NOTES.

The ratepayers of Yeadon seem to be a little chary about adopting an electric lighting scheme which the District Council wish to undertake; their fear being that, in a scattered place like Yeadon, it will not pay. The question was placed before a public meeting last Friday week. The principal speaker was Mr. F. H. Medhurst, who had been called in by the Council to advise on the tenders submitted, and had recommended the acceptance of the tender and scheme of the Brush Company. The tender, he said, amounted to £5487; but it did not include buildings, foundations, connections with the consumers' premises, excavating and making the roads good again, sundry charges, contingencies, &c., which he estimated at £1795—thus bringing the total cost up to £7282. The plant was to be equal to supplying 1800 lamps, besides 146 street-lamps; and although the undertaking would not quite pay interest and sinking fund during the first and second years, he believed that in subsequent years there would be a surplus. The charge proposed to be made was 10s. per lamp per year. Among the speakers who condemned the proposal was the Chairman of the Council (Mr. Hudson). After a full discussion, it was decided to defer the question for three months; and, in the meantime, the Council are to ascertain the number of lamps that would be taken up.

An application of the St. Helens Corporation to the Local Government Board for sanction to borrow £10,000 for the purposes of electric lighting was the subject of inquiry by Mr. F. H. Tulloch last Tuesday. The case for the Corporation, as stated by the Town Clerk (Mr. W. J. Jeeves), was that the Corporation owned the gas undertaking, and had therefore a special interest in keeping control over the electric lighting. In former years, there had been applications by various companies for Provisional Orders to authorize them to supply electricity within the borough, which had been consistently opposed by the Corporation, as they felt that they ought to have control themselves, but believed the time had not then come for the installation of the light. In 1894, the Corporation considered they ought to have power to put down an installation; and they therefore applied for an Order, which was granted. It was proposed to put down an installation at the gas-works. The plant would be sufficient to meet any demands for electric lighting likely to be made within the immediate future, and would be capable of extension should the requirements warrant it. The fact that the new technical school and free library, now in course of erection, would be lighted by electricity, was the particular reason for the application, and formed the policy by which the Corporation were actuated. In reply to the Inspector, the Town Clerk stated that the contracts for the plant had been let, subject to the approval of the Local Government Board. The application was not opposed.

The Liverpool City Council last Wednesday passed a resolution to the effect that, in accordance with the agreement dated May 28, 1895, between the Liverpool Electric Supply Company, Limited, of the one part, and the Corporation of the other part, a further agreement be made by the Corporation with the Company to complete the purchase of their undertaking, works, and property within six weeks from the date of an Act of Parliament authorizing the sale to the Corporation, provided the Act is passed in the year 1896.

The Exeter City Council last Wednesday decided to affix the seal to a conditional agreement with the Electric Lighting Company for the sale and purchase of their undertaking. The agreement is for the Council to purchase the works, subject to the approval of the Board of Trade and the sanction of the Local Government Board, for the sum of £7500. It was also resolved to make application to the Local Government Board for permission to borrow £11,000 for the purposes of electric lighting. It was anticipated that £3000 would have to be expended, in addition to the purchase-money, in laying down new dynamos and other plant.

The Hull Corporation having applied to the Local Government Board for permission to borrow £8000 for the purposes of electric lighting, an inquiry into the matter was held by Mr. R. Walton last Wednesday. It appeared from the statement of the Town Clerk (Mr. R. H. Dawe) that £4324 had already been expended in payment of contracts which were in excess of previous estimates; and the balance was required for the purchase of plant to meet the increased demands for the light.

The electric lighting capital account presented to the Hampstead Vestry last Thursday evening showed a deficiency on the 25th ult. of £522. Mr. Johnson wished to know what was being done in the matter of this gradually increasing deficit, and whether any steps were being taken with reference to raising fresh loans. The Vestry Clerk (Mr. A. P. Johnson) pacified the inquisitive member by stating that the Committee would consider the whole matter at their next meeting.

The electric lighting question was discussed at a special meeting of the Swansea Town Council last Wednesday; and a scheme adopted by a majority of one—eleven members being absent. We can only briefly record the fact to-day; but we may at the same time express the belief that the decision will be challenged, and the matter dealt with afresh by a fuller assembly of councillors.

A fire broke out early last Sunday morning at 91, Onslow Gardens, South Kensington—a private residence in the occupation of Mr. A. Hughes. A man passing the house noticed flames issuing from a grating close to the pavement. On an examination being made of the vault under the roadway, it was discovered that an electric transformer had caught fire. The flames were speedily extinguished; but the electric apparatus was completely destroyed.

EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly General Assembly of the proprietors was held last Thursday at the Company's Offices, St. Helen's Place, E.C.—Mr. GEORGE BANBURY presiding.

Mr. J. PURSER having read the notice calling the meeting, the report was taken as read.

The CHAIRMAN stated that the increase in revenue from water-rates during the last six months, when compared with the amount received in the corresponding period of the previous year, was £5458; showing that their anticipations as regarded the extension of building operations in that part of their area which was outside the Metropolitan district were being realized. The income derived from the houses newly supplied averaged only £1 1s. 0¾d. per tenement; and when one calculated that they gave their consumers 36 gallons per head per day (which was really more than anyone could fairly use), this cost only came to about ¾d. a week for each individual. Many of the shareholders might say that the business of supplying thousands of houses, as they now did, at rates considerably below this average, must be rather a philanthropic than a remunerative undertaking; but they must take the bad with the good. At their last meeting, he spoke about the long and severe frost of 1895—unparalleled, he believed, during the present century. He also alluded to the measures they had taken to mitigate the great inconveniences to their customers; and he further mentioned the heavy demand that would be made upon their exchequer through this memorable winter. This half year they had to meet that demand; and the increase in their working expenses—purely owing, he might say, to this severe winter frost—came to no less than £18,700, thus eating up the whole of their reserve fund, which they had been putting by from time to time with such care. This heavy charge included a sum of £3617 for the hire of water-carts from vestries and local boards, to convey water to frozen-out consumers. It was, indeed, a severe task afterwards to repair all the bursts in the mains and the broken service-pipes over so large an area as that which they had to deal with. It was, however, all completed in the London district by the 8th of April, and in the outside district by the 19th of that month; so that those very ingenious, but very ill-informed minds that attributed their subsequent excessive pumping to "shattered mains," were singularly in error. The expression "shattered mains" was somewhat catching; but it was most delusive and erroneous. Owing to their having had, as usual, to oppose Bills brought against them in Parliament by the London County Council, there was an increase of £1600 in law charges; and there was the customary unwelcome rise in rates and taxes to the parishes. The increase this year was £1600; and their annual payment to the parishes now was £30,000. From whom this amount was to be extracted when the Company no longer existed to pay it, was rather a curious problem. He did not know from whom they would get it then. As to the progress of works, although Mr. Bryan's time and attention had been greatly taken up by other important matters, excellent progress had been made with the works now in hand. Their two large covered reservoirs at Buckhurst Hill and Hagger Lane were very near completion. The reservoir at Hagger Lane would contain 8 million gallons; and both would supply householders by gravitation. At Ferry Lane, their new filter-beds and triple expansion engine were at work, doing very good service in the Essex district. Improvements and measures for increasing their power of supply were being carried out at Chingford, Walthamstow, and Lea Bridge; and the enlargement of the present Racecourse reservoir, so as to increase its capacity by nearly 200 million gallons, had made such excellent progress under Messrs. Kirk and Randall, that they hoped it might be completed at the end of the year. But the main, and most interesting operations were the construction of the two large reservoirs at Walthamstow, comprising a water area of 80 acres, and capable of holding about 400 million gallons. Messrs. John Aird and Sons obtained the contract by tender; and the rapid progress made, owing to this firm's abundant resources as regarded skilled superintendence, men, and plant, had been everywhere acknowledged, and duly appreciated. When he was there last, he found that 29 steam-engines were employed for various purposes, and that six locomotives were running over six miles of rail. When one watched the progress of these extensive works—which would be a blessing, not only to the present, but to future generations—it was strange to think that they would be completed in spite of the relentless opposition and unceasing obstruction of the Progressives of the London County Council, and in spite of the votes and would-be veto of the then Government. These were the works authorized by the Bill which they were enabled to get through the House of Commons by a majority of one vote. When that Bill was sent to the Committee after this severe struggle, the latter were so impressed with the necessity of the proposed works that they ordered them "to be prosecuted with all due diligence;" and this had been done faithfully and energetically. The Government Analyst (Dr. Frankland) gave their water a high character. He ranked them next to the New River in regard to purity; and stated "that after our storage and efficient filtration, the water was of excellent chemical and bacterial quality for dietetic purposes." Their whole financial position—and their very existence, indeed—depended on what was going to take place in Parliament; so it was best to tell them the exact state of their affairs. At the last meeting, he mentioned that the Bills for the acquisition of the Lambeth and the Southwark and Vauxhall Water-Works, promoted by the London County Council, had been referred to a Select Committee, eventually presided over by the Hon. David Plunket; and that the Bills of the other Companies were down for second reading on May 3. That was the position when he last addressed them. As regarded the latter Bills, postponements followed from time to time; so that the second reading of them did not take place before the somewhat sudden dissolution of Parliament. In the case of the two former Bills, the other Companies and the outside authorities were allowed to appear before the Committee, and show cause against those principles and provisions in the Bills which they deemed objectionable, and which were common to all the other Bills to be brought up thereafter. This naturally lengthened the inquiry,

which virtually resolved itself into a discussion as to the basis upon which all the Companies should be eventually purchased. The Committee began their sittings on May 14, and continued them until July 3, when the Chairman announced "that they had nothing to do but dissolve themselves, because of the early dissolution of Parliament." The inquiry was necessarily incomplete; and the Committee did not, in fact, decide whether, in face of the important evidence produced, and the decided objections of the outside authorities, the London County Council were the proper body to whom the Water Companies should be eventually sold. He might mention that before the Committee two members of the London County Council came forward, and deprecated the transfer to their body. They were two very prominent members of the Council; and their evidence might have carried some weight. He might briefly mention two important principles which the Committee laid down, subject to the main question of transfer being decided. First, as regarded the specific and one-sided instructions which the London County Council wanted to be given to the Arbitrators, and which would have compelled the latter to exclude from consideration points which enhanced, and to consider points which depreciated the value of the undertakings, the Committee recorded as follows: "They do not feel justified in endeavouring to influence in any way the impartial exercise of that (the Arbitrators') discretion; and they are unwilling, by special reference to particular circumstances, to seem to prejudge their consideration, or by implication to exclude or affect the consideration of any others which may be submitted to the Arbitrators"—thus leaving the Arbitrators free and unfettered in their powers, as such persons ever should be. The second important point was that the whole of the Companies should be taken over simultaneously; thereby preventing competition with, and unfair treatment towards, those which would have remained to be bought. The Committee conceded to the Companies these two very important points, upon which their Counsel laid great stress. There were other unjust and objectionable provisions in the Bills; and one of them was rather extraordinary, for by it they were to be given over at a date long before the County Council had paid the purchase price, or even before the Arbitrators had made their award. There was also the power to cancel previous engagements and contracts. The important contract for the two large reservoirs at Walthamstow might thus have been put an end to. Time, however, had not permitted discussion on these provisions; but from what they saw, there was every reason for believing that they would have been fairly dealt with throughout by that Committee. There seemed to be no doubt that the inquiry before Mr. Plunket was abortive as regarded practical result, and that the Committee itself was defunct—indeed, several of its members had not been returned to Parliament. As to the future, he learned that the London County Council could, if they so decided, move that the two Bills relating to the Lambeth and Southwark and Vauxhall Companies be referred to a fresh Committee; but they could not go on from where they left off, and the inquiry must be re-opened *ab initio*. The other Bills which were not read a second time could be introduced into the House at the stage at which they were left; but it was apprehended that no new matter involving any change of principle could be inserted into them. The expenditure of thousands of pounds in repeatedly defending these cases against the London County Council, was a very serious matter to their shareholders; but their adversaries could advance against them with a light heart, knowing, as they did, that the unrepining ratepayer had to settle their bills. He now came to a delicate point, upon which he could not say as much as he had at first intended; but they would naturally expect him to refer to the recent great drought, and its unfortunate effects upon their consumers and themselves. He had been prepared to explain to them all the details, and the complete answers which the Company had to the various charges which had been made against them; but, as they were aware, the Local Government Board had ordered an inquiry into all the circumstances. As that inquiry was now proceeding, it would be unbecoming on his part, and even disrespectful, to the Commissioners if he were to dilate upon the facts about to be placed before them. They would, however, have seen the letters and statements of the Company in the Press; and there was a singularly clear and comprehensive report in *The Times* of Aug. 6, from their special correspondent, which very impartially summed up the whole case. He might, however, just briefly say that there were two articles in *The Times*—one on July 29 and the other on Aug. 6—which put the case so clearly, that they were really well worth reading and considering. He had thought of having the two articles printed, so that they might take them away with them from that meeting; but other things had caused him to overlook the matter. He might just briefly remark that, had it not been for the action of the London County Council, there would have been no occasion to resort to an intermittent supply; and if people had only had cisterns in their houses, as prescribed by law, no practical inconveniences would have arisen when the intermittent supply was resorted to. He might add that they resumed the constant supply on Sept. 8. He must say one word upon the important question of waste. There was a well-known authority—a civil engineer—who lately wrote in *The Times*: "Unfortunately, London householders have not yet learned the lesson that waste of water is a grave offence against the community at large." This was, indeed, true; and their consumers, having grown accustomed to receiving an unlimited supply, had become thorough spendthrifts in its use. As the water belonged to a private company and not to a municipality, great extravagance, rather than reasonable economy, was the order of the day. If in days to come they were taken over by a municipality, he fancied that the means the latter would take to prevent waste would be more strict than those of the Company; and people would also consider that it was advisable to keep the consumption down in view of the rates. He had on several occasions mentioned their Engineer's wonderful power of overcoming difficulties, and of carrying out improvements and extensions; but this year his task had been unusually severe, owing to the drought and frost. In fact, he had been tried to the utmost; but he was happy to say that Mr. Bryan's health still continued, and he (the Chairman) trusted that when the existing difficulties were over, he would be able to go away for a time and rest in quietude. Mr. Crookenden, as usual, had afforded them great aid during the parliamentary inquiry; and of late his post had been one of great difficulty, for he had been very much harassed. Both these gentlemen were at that moment attending the inquiry before the Commissioners. In conclusion, he might say that the proprietors doubtless clearly understood that the memorable and, to the Company, disastrous frost of last winter, had not only caused them infinite trouble and anxiety in alleviating the inconvenience to their consumers, but had also hit them very hard financially. It had compelled them to reduce their dividend, and had swallowed up all their reserve fund. They had thought it the wisest course to settle these heavy frost bills as they came in, and not allow them to remain as troublesome demands upon future income. Although they had thus received a temporary financial blow, there was little cause for anxiety. Their constitution was sound, and they possessed plenty of recuperative power. Their area of supply was increasing in population, their new works would ere long be aiding them most materially, and their whole system—in the shape of engines, mains, reservoirs, and plant—was in excellent order; so that, with seasons even of the most ordinary character, and with trade maintaining its present aspect, they might reasonably hope to regain their former position. They, as Directors, certainly welcomed the Local Government Board inquiry now being held regarding the temporary cessation of the constant supply, as there appeared to be no ground for apprehension. In fact, they rather courted the investigation; for, as the proprietors were all by this time aware, whenever their case came before a just and competent tribunal, they invariably benefited thereby. He then proposed—"That the Directors' report and accounts submitted to the meeting be received and adopted, and that, as recommended by the Directors, a dividend of 3½ per cent. (less income-tax) on the ordinary stock of the Company for the half year ending Midsummer, 1895, be declared."

Mr. H. DALTON seconded the motion.

Mr. F. B. BROWN said that their money had been wasted in the frequent attacks made on their property. First, there was a Royal Commission; and the result was that they were exonerated. But not satisfied with that, another complaint was urged against them—this time about the frost of last year. He did not, however, suppose that they were the only Company that suffered from deficiency of water. He was at Brighton last summer, and could not get any water for three weeks. Because they were private individuals, they were attacked. The Chairman had said that the Directors welcomed the present inquiry; but as a shareholder, he did not. As it was, their dividends had been reduced by ½ per cent.; and he thought it was time that the inquiries into their affairs were put a stop to. Although they had spent £20,000 extra through the frost, yet some portions of the Press had said that the Company had done nothing to relieve the inconvenience and suffering caused by the frost. He hoped the Directors would not get frightened by the attacks on them, and spend the shareholders' money too freely. He was sure that the shareholders as a body would support them in meeting the unjust and lying charges which had been made against the Company.

Mr. ILSLEY said he thought that the pending inquiry was a good thing for them, as it would enable the Directors to answer so perfectly the charges brought against them. There was a mania on the part of some people against Water Companies. Anything said to their detriment, was accepted by these people as fact; and they could not listen to what was urged on the other side. It was absurd to talk of a "water famine" where people were offered, as by their Company, 25 to 30 gallons per head per day; but it was not the Company's duty, and they had not the power, to place proper vessels in people's houses for the reception of the water.

Dr. CHESSHIRE referred to the latest scheme of the London County Council for obtaining a water supply as the most ludicrous he had ever heard of. He had a paper in his hand, which informed him that in Glamorganshire and Cardiganshire people were crying out for water. It was therefore absurd to go to a place for water where none existed.

Mr. GOODWIN said he had heard with satisfaction that the Directors courted the inquiry now being made by the Local Government Board; and he trusted they would come out of it triumphantly. What, however, had struck him, as an outsider, was that it was most unfortunate that the East London Company should have been the only Company to stop the constant supply, and against which allegations had been made with reference to the supply to poor people. All the Water Companies were, as it were, on their trial; and it was most unfortunate that at such a juncture their Company's property should be depreciated.

The CHAIRMAN suggested that these matters should not be discussed at that moment, in view of what he had already said as to the Commission that was now sitting, but for which, as he had pointed out in his opening remarks, he had been prepared to explain everything, and give complete answers to the allegations made against the Company.

Mr. GOODWIN said he was quite in the Chairman's hands; but he hoped that the shareholders, after the inquiry, would have an opportunity of hearing more on the subject, and that it would not be left simply for the public Press to discuss.

The CHAIRMAN, in reply to questions, said that they were bound to give the constant supply in the Metropolitan area; but outside it was not compulsory. It could hardly be said that the shareholders' money had been thrown away in connection with the inquiries which had been made into their affairs, for the decisions which had been given had been greatly to their benefit; and the misstatements which were sometimes made against them in certain organs of the Press were thus answered. Mr. Ilsley had said it was absurd to call what had occurred a famine; but he had noticed that that word was always put in inverted commas in those papers which knew anything about the matter. The scheme proposed by Mr. Binnie and the London County Council for a water supply, would be subjected to a great deal of criticism; but he did not think it would be advisable for him to say anything further about it. He then put the resolution; and it was carried unanimously.

Mr. ILSLEY proposed a cordial vote of thanks to the Chairman and Directors.

Dr. CHESSHIRE, in seconding the motion, stated that in Birmingham, where the water undertaking had been sold to the County Council, the rates had recently been put up by 33 per cent.; which was "only a very small instalment" of what was coming on the ratepayers.

The motion was carried; and a similar vote was afterwards passed to the Engineer and the Secretary.

THE RECENT SCARCITY OF WATER AT THE EAST-END.

Proceedings to be Taken against the East London Water Company.

At the Meeting of the London County Council last Tuesday, the Public Control and Water Joint Committee reported that, after due consideration of the matter of the deficient water supply in the East-end of London, they had come to the conclusion, upon the advice of Counsel, that they should prosecute the East London Water Company for penalties under the Metropolis Water Act, 1871. They therefore recommended that the Solicitor be instructed to take proceedings against the Company for failure to maintain a constant supply, as required by the provisions of the Act. Mr. Beachcroft pointed out that a Local Government Board inquiry upon this very matter was in progress; and surely, he said, it would be in their interests to wait and know the result before they put themselves in such an antagonistic attitude towards the Company as to prosecute them for penalties. They owed a little mercy even to the Water Companies. He could not believe that any of the Companies were wilfully at fault, or that the Directors were anxious to diminish the quantity of water in their pipes, or to favour one set of consumers as against another. He moved the following amendment: "That it is inexpedient for the Council to commence proceedings against the East London Water Company without further information as to the advantage to be secured to the ratepayers by a conviction, pending the Local Government Board inquiry; and that accordingly the Committee be instructed to bring up a further report at the conclusion of that inquiry." Sir J. Dimsdale seconded the amendment; but, on a division, it was lost by 16 votes to 64.

Local Government Board Inquiry.

The inquiry instituted by the Local Government Board into the alleged deficiency of water supplied by the East London Water Company was opened at the Hackney Town Hall last Tuesday, before Colonel DUCAT, R.E., and Dr. F. W. BARRY, two of the Board's Inspectors.

The investigation was held at the instance of the East London Vestries, who were represented by Mr. BALFOUR BROWNE, Q.C., Mr. T. H. BEVAN, and Mr. W. H. ELDRIDGE; Mr. W. A. BLAXLAND (Solicitor) and Mr. FREEMAN appeared for the London County Council; Mr. G. P. GOLDNEY (City Remembrancer) for the Corporation of London; and Mr. PEMBER, Q.C., and Mr. CRIPPS, Q.C., M.P., for the East London Company.

Mr. BALFOUR BROWNE, in opening the case, said this was an inquiry instituted by the Local Government Board, on the application of the Hackney Vestry and other Local Authorities, into the causes and effects of a scarcity of water which prevailed in the East-end of London during June, July, and August last. A letter dated Sept. 3, 1895, received from the Local Government Board ran as follows: "I am instructed by the President of the Local Government Board to state that, having considered the representations that were submitted by the deputation which attended here on the 30th ult., he has given directions for the holding of an inquiry as to the circumstances which occasioned the deficiency of water supply in the Metropolitan area comprised in the district of the East London Water-Works Company, the effects of the widespread deficient water supply having regard to the public health, and the means which should be adopted with the view of preventing the recurrence of such difficulty." First, with regard to the scarcity of water, there could be no doubt whatever; but as to the "widespread" scarcity, that would have to be proved. The effects of a deficient water supply would be given by various witnesses. Possibly his friend Mr. Cripps would admit that, if the supply was not sufficient, the effects would be deleterious on a teeming population like that in the East-end of London. As to the means which should be adopted with the view of preventing a recurrence of any such deficiency, the suggestions of the promoters of the inquiry could only be tentative. They awaited with some impatience what the East London Water Company proposed in order to avoid this deficiency in the future. The inference from the facts was that the primary cause of it in the past was the Company's negligence. They supplied an area estimated to contain a population of 1,202,557 persons; and the quantity of water required to serve it was between 40 to 50 million gallons per day. The Company's sources of supply were mainly from the Rivers Lea and Thames. They had power to draw from the Thames about 10 million gallons a day; and there were a very large number of important works, some of which were merely for the collection, and others for the pumping, of water. These works were situated at Walthamstow, Lea Bridge, Chingford, Sunbury, Hornsey Wood, High Beach, Woodford, and Waltham Abbey; but the most important were at Lea Bridge. The Company were incorporated in 1807; but in 1852, after the cholera epidemic in London, the Act of 1807 and another of the Company's Acts were repealed. Their district was afterwards extended; and various provisions were made, one of which bore upon the question of constant supply. In 1852 and 1863, further Water Acts were passed; but the Metropolis Water Act of 1871 was the principal statute on this subject. Under section 7 of the Act, the provisions that had formerly been made with regard to constant supply were somewhat modified. The section provided for a supply of pure and wholesome water sufficient for the domestic purposes of the inhabitants constantly laid on at such pressure as would make the water reach the top storey of the highest house in the Company's district. There were various other provisions in the Act as to when the constant supply was to be demanded. Section 15 specified that, "notwithstanding anything in this Act, a company shall not be subject to any liability for not giving a constant supply if the want of such supply arises from frost, unusual drought, or other unavoidable cause or accident." This exempted the Company from the duty, and also, of course, from the penalty for not performing that duty, under such conditions. They would see whether or not these conditions exempted the Company in this case, or whether the cause of this scarcity was outside this section altogether. Then, by section 16, a company who violated, refused, or neglected to comply with any of the provisions of the Act were to be liable to a penalty of £200, with a further penalty not exceeding £100. With regard to the last section, his clients were not asking for a penalty, because the Local Government Board, which had taken the place of the Board of Trade, had no power to award penalties, which they must go for elsewhere. He (Mr. Balfour Browne) understood the Inspectors' functions were under the Metropolis Water Act, 1852, section 9 of which specified that, "if at any time complaint as to the quantity or quality of the water supplied by any company for domestic use be made to the Board of Trade by memorial in writing signed by not less than twenty inhabitant householders," the Board of Trade could appoint a competent person to inquire and report upon the matter. The Inspectors' functions were, however, not confined to the memorial of the twenty householders; for there was a conference of the Local Authorities in the district, and the inquiry would therefore also proceed under the Public Health (London) Act, 1891. Section 293 of this Act gave the Local Government Board Inspectors power to inquire, at the instance of the Vestries, into matters concerning the public health in the district supplied by the Water Company.

Mr. CRIPPS, on behalf of the Company, said it would shorten the case if he stated that they would not take any technical objection to the inquiry.

Mr. BALFOUR BROWNE said it became the duty of the Company, by virtue of the Act of 1871, under certain conditions, to furnish a constant supply of water. He believed the Company claimed to be the pioneers in giving a constant supply; and if this were so, it was greatly to their credit. But the Act of Parliament said that, when once a constant supply had been given, it was the duty of the Company to continue it, for very obvious reasons. Many of them remembered when in other districts in London an intermittent supply was given; the water being stored in cisterns. That system had been condemned by the Act of 1852, and also, by implication, by the Act of 1871; and it was condemned by the East London Company, who, in conjunction with various local authorities, took steps to have the cisterns done away with in their own district, and therefore made his clients absolutely dependent upon a constant supply, which they had now failed to give. This question of the scarcity of water was complicated in this particular year. Before the severe frost, the Company came to the conclusion that it was necessary to put persons upon a short supply; and the night supply to a great number of houses in the district was cut off. When the frost came, owing to the position in which the pipes were laid, there was a stoppage of water in a large number of districts; and many houses were without it for six weeks. Consequent also upon the frost, serious damage had been done to the mains and service-pipes. This was owing to the neglect of the Company to repair their pipes; and an enormous amount of water escaped through the leakages caused by fractures during the frost. This accounted for the scarcity of water in June, July, and August. On the 12th of July, the Company issued a circular stating that, in consequence of the unprecedented and continued drought, the hours of supply must be materially curtailed. Consumers were requested to store a reserve while the water was on, and to abstain from using it for any purposes whatever other than domestic necessities. The watering of gardens by sprinklers and hose was strictly prohibited for the time being. The recommendation that their consumers should store water, they not having the necessary means of doing so to any extent, was really adding insult to injury. On the 15th of July, a large public meeting was held on this question; and a protest was unanimously carried in consequence of the shortness of supply, and a similar resolution was passed on the 1st of August, when there was another meeting. The points raised were, first, as to scarcity; secondly, as to the effects of that scarcity; and, thirdly, as to its cause. It would hardly be denied that the pubic health suffered through this deficient supply. The people had to get their water at the stand-pipes; and they boarded the water-carts, provided for watering the streets, and dipped in their jugs to get water for their domestic necessities. It would be proved over and over again that, in every district included in the Company's limits, the Company did not use all the means in their power to maintain a constant supply. Then, again, he should establish the fact that the Company unduly favoured one class of consumers to the detriment of another class, to the pecuniary profit of the Company. Those consumers who paid the Company in proportion to the quantity of water they received had water; and those who paid whether they got water or not, had none. The fourth complaint against the Company was that the scarcity of water was mainly to be attributed to the leakage from their defective mains and service-pipes. As to the first charge—that the Company did not use every means in their power to give a constant supply—they had the right to draw 10 million gallons a day from the Thames at Sunbury. During June, when the drought was excessive, though not so bad as it was afterwards, they drew less than 7½ millions a day from that source. He was told that the Company's main for conveying this water was not sufficient for the whole 10 million gallons; for in July they only drew, on an average, 9 million gallons daily. Besides this, there was a power among the London Water Companies for the intersale of water. He did not find that this Company purchased water from any of the Companies, except a very small quantity upon one occasion, and this late in the drought, from the New River Company. Then, again, owing to some curious carelessness at the time that, or just before, the drought commenced, their principal storage reservoir was emptied for the purpose of being deepened. It was culpable carelessness not to have exercised sufficient forethought to have avoided such a thing. Then, again, the Company were unfair in their distribution of water; for some manufacturers who had theirs by meter were supplied, while it was refused to those who wanted it for domestic use. During the whole time that the people of East London were getting no water, the Tottenham Local Board had a supply, which was paid for by meter and not by rates. Next there was a charge of delay in the construction of the reservoir. The Company admitted that their storage was defective; but they blamed the London County Council for having opposed a Bill by which they sought to secure a larger amount of storage. The fact was that the Bill was opposed for other things than the storage of water; and, indeed, the Company's own Engineer stated that, if the population of the East-end went on increasing for the next thirty years as it had done in the past thirty years, they would be well able to cope with the supply under

existing conditions; and, further, that the Company possessed storage for 17 days, which was not equalled by any other of the London Companies—some of them running down to only two or three days.

Mr. CRIPPS remarked that that evidence was not given before the Parliamentary Committee, but before the Royal Commission on the Metropolitan Water Supply.

Mr. BALFOUR BROWNE said at any rate the evidence was given before the Company went to Parliament; and therefore the Committee might well have refused further powers of storage when their Engineer had said they were provided for thirty years. But there was no reason why the Company should have waited for parliamentary powers to increase their storage works; it was only necessary that they should forego some of their large profits, and make these works. Another thing the Company might have done was to have laid their mains deeper, which would have prevented an enormous waste of water when they were fractured by the frost. However, they preferred remedying defects at the expense of the ratepayers rather than of their own shareholders. The case for the Water Company would be that the season had been a very dry one; but there had been droughts just as serious before, though not coming after fractured mains from frost. The Company said that, if the people would only have cisterns in their houses, this calamity would not have occurred. But it was to do away with cisterns that the constant supply had to be laid on; and they wanted to go back to an obsolete and improper system, in order to remedy the evils which they could obviate without this assistance. The Company might say that leakage did take place from the mains, but that it was from the service-pipes, which belonged to the consumers. This plea, however, would not do; for if a water company in the first instance laid a main too near the surface, the service-pipe must necessarily also be too near the surface. Again, it would not do for a company to say all the water was running to waste through the service-pipes being fractured; for they had powers to compel anyone in the district to repair those pipes. This was a short sketch of the case. He would show that the scarcity of water had existed over the whole of the Company's district, and that it had been due to their negligence.

Mr. CRIPPS said the chief question here was rather the cause of the scarcity, and the means to prevent it in the future, than the fact of the scarcity.

Mr. BALFOUR BROWNE said he proposed to show, in the first instance, how widespread was the scarcity.

Mr. CRIPPS: This is not a widespread scarcity; but we admit that the constant supply for a time had to be replaced by an intermittent supply; and then the question would be what caused that. Our view is that it was owing to the unusual drought and the obstructive action of the London County Council. I suppose we shall have to discuss the effect of the scarcity on the public health.

Mr. BALFOUR BROWNE: Yes.

Evidence was then called by the complainants.

Dr. *H. J. Buch*, a medical man in practice at Clapton, was the first witness. He prefaced his evidence by stating that, had it not been for the discourtesy of the Company in not answering his letters, he would not have been a witness. He had to go without his bath, which was a most distressing circumstance to him. In cross-examination, he admitted that no infectious or other disease was caused by the want of water; only the excessive inconvenience of the lack of water for sanitary purposes.

Mrs. *Clayton*, a midwife, spoke of the inconvenience she had experienced from want of water; Mr. *Ward*, a coffee-shop keeper, testified to his trade suffering; and Mrs. *Dunscombe* and Mrs. *Staunton*, laundresses, brought forward complaints.

The next batch of witnesses were officials of local authorities. The first of these was Dr. *J. King Warry*, the Medical Officer of Health for Hackney. He said that during June, July, and August, there was a great scarcity of water; and the period of the lowest supply was from the 15th of July till the 18th of August. The water was on from two to three hours a day. Where a district was dependent upon a constant supply, it did not lend itself to an intermittent supply; for it did away with storage in low-class houses. Asked what would be the first indication of the sanitary mischief of cutting off the supply, he said there would be a general lowering of the health, from the people being exposed to foul smells from water-closets. He found the death-rate of the Hackney district during five weeks from the 15th of July to the 18th of August was 23·3 per 1000, and for the remainder of London, 21·7 per 1000. The people suffered from summer diarrhœa during those five weeks; and it was aggravated through the scarcity of water. The deaths from diarrhœa and enteritis were 7·5 per 1000; whereas in the rest of London the rate was 4·8 per 1000. Those figures referred to a population of 144,131.

Cross-examined by Mr. CRIPPS: The death-rate from diarrhœa was 4·8 for the part of the district supplied by the Company; and for the rest of London, 3·1. He had no statistics for the same period in 1893 and 1894. Asked if he had supplied figures to show that in one district of Hackney the death-rate went in a week to 71·5 per 1000 above the normal death-rate of London, witness replied that he had not; but in one week it went up to 59 per 1000.

In re-examination by Mr. BALFOUR BROWNE, witness said he considered that the comparison between Hackney and the rest of London was a fair one.

Dr. BARRY remarked that the 59 per 1000 in the district cited, with 7500 inhabitants, was derived from very small figures.

Mr. *J. Gough*, one of the Inspectors of Nuisances for Hackney, said complaints were made of insufficient water for ordinary domestic purposes; but the majority were to the effect that the parties had not sufficient water for flushing closets. The water was only on an hour or two each day from the middle of July to the end of August.

Dr. *F. W. Alexander*, the Medical Officer of Health for Poplar and Bromley, spoke to the possible relation between the scarcity of water and zymotic diseases, and compared the deaths from the latter in Poplar and Bromley with the rest of London—the former always being higher during the scarcity of water. The deaths from diarrhœa had gone up, as compared with 1893 and 1894. There had not been an exceptionally small quantity of rain in 1895—in fact, the year agreed with 1894; but was a little more than in 1893. The rain helped to flush the drains. He considered that cisterns in a poor and crowded district, where the people would not cover or clean them, would result in a very bad state of affairs indeed. Almost immediately after the first circular issued by the Water Company, there was ½ inch of rain in one week; and in the next week, more than 1¼ inches. If there had not been this rain, he thought the soil would have stopped in the sewers, and putrefaction would have been set up.

Dr. *G. A. Rogers*, the Medical Officer of Health for Limehouse, said the deaths from diarrhœa and gastro-enteritis showed an increase at the same time that the constant supply of water was cut off. The death-rate was 8·1 per 1000, as against 4·5 in the rest of the Metropolis; and 6·2 in the period of drought of 1893 in his district. Considering that the drains must have been very full of soil, they might take it that this caused the increase of diarrhœa and gastro-enteritis.

Mr. *Mansell*, the Sanitary Inspector for the Homerton District, said they had general complaints of the closets being stopped and choked through an insufficient flush of water, caused by the supply of water being discontinued.

On the following day, evidence for the Vestries was continued.

Dr. *G. P. Bate*, the Medical Officer of Health for Bethnal Green, said that his district had a population of 127,000; and there were between 17,000 and 18,000 houses. Four-fifths of the houses had small yards attached; and generally each had its own closet. Twenty years ago, the supply of water was intermittent, which was not conducive to health; but for this a continuous supply was substituted, and a great improvement took place. In June, July, and August last, there was much scarcity of water, and a corresponding increase in the rate of mortality. The fire-mains were kept charged; and anyone who had his water from these had his supply continued. Most of the consumers, however, were served from the mains, whence there was only a supply for two hours a day. He had taken out the figures with reference to diarrhœa, and made a comparison between eight weeks in 1894 and 1895, with the result that there were 29 deaths for 1894 as against 101 for 1895. He attributed this great increase to the shortness of water. It had been stated officially that upwards of 30 gallons per head per day were pumped into the district during the period of water famine; and he thought 12 gallons per head were sufficient from a medical point of view, without allowing for water for trade purposes. In his opinion, there was an enormous waste somewhere. Consumers were as careless as they could be, and were too lazy to turn off the taps. The fittings were often tied up with string.

Mr. FREEMAN said he attended for the London County Council, who considered it only respectful to the Commission that they should be represented by Counsel. Should they be attacked, he would, of course, have an opportunity of defending them.

Mr. PEMBER said the Inspectors would judge as to whether there should be any rebutting evidence called; but he must insist upon his right, as defendant in the case, to speak the last word.

Mr. BALFOUR BROWNE said they would leave the Company to explain the cause of the scarcity; and it might be necessary to rebut this defence. Though it was for his clients to make out a *primâ facie* case, the main burden of the inquiry must fall upon the Company. He had no means of going to their mains and finding out where they were leaking, or what quantity of water was being wasted.

Mr. PEMBER said he admitted that the complainants were enabled to give rebutting evidence; but he should claim to answer it.

Colonel DUCAT: I think that is perfectly fair.

Mr. FREEMAN: I am here in a different capacity from Mr. Balfour Browne, who is bringing certain allegations before you. I am here more to assist the Commissioners by anything that may arise in the case. For instance, Mr. Cripps stated yesterday that the cause of the shortness of water was—partly, at any rate—owing to the fault of the London County Council; and if evidence is tendered to this effect, I shall claim to answer it, and to lay my facts before the Commission. My learned friend agrees with me.

Mr. PEMBER: Certainly not. Mr. Freeman has known for a long time that the County Council are blamed for this scarcity, partly owing to their opposition to the Company's Bill in 1893; and it is for him to put someone in the box to tell us the truth about the rejection of that Bill. If he does this, then I shall tell my story. Of course, if we should say anything which would entitle my friend to call rebutting evidence, we shall not object.

Dr. *Bate* was then cross-examined by Mr. PEMBER. He said the Company took the initiative in supplying water continuously. He knew that he could only get water two hours a day at his surgery. He could not tell whether there was an increase in the deaths from diarrhœa in other parts of London during the water famine in the East-end; nor could he tell whether there was an unusual increase in the death-rate from that disease in other large towns of England during the months of June, July, and August.

In re-examination by Mr. BALFOUR BROWNE, witness said that the drought would have been mitigated if there had been cisterns in the houses of the consumers; but if cisterns had to be maintained in order to meet such a contingency, it would be a very costly and unsatisfactory procedure.

In reply to Dr. BARRY, witness said his district was a crowded one; and the comparison of the death-rate was with his district and the whole of London. There was an increase in the death-rate all over London in the month of July.

Dr. BARRY: Would the increase in your district be normally higher than in the rest of London?

Witness: Not higher than in similarly crowded districts.

Take it in another Water Company's district. Would the increase be greater proportionally during June, July, and August than in the three previous months?—I have not gone into that, and should not like to say.

Mr. *F. W. Barratt*, the Surveyor to the Vestry of Bethnal Green, a district with a population of about 123,000, said that in ordinary times they employed 18 water-vans. These vans were in full work until the Company said they were short of water, and asked the Vestry not to use them; and the vans were reduced to six, at which they had continued up to the present. Another duty they had was the flushing of sewers and courts; and this the Company stopped on the 13th of July. A letter was written to the Company. They replied that they had

not given orders to stop the flushing of the sewers; and they would do all that they could to aid them—in fact, "they were pumping 30 gallons per head per day for all purposes." However, the water was shut off in all the branch mains for the greater part of the day; and the Vestry gave up trying to draw from them. There was a great deal of waste going on in the consumers' pipes; and the Vestry wrote several letters to the Engineer of the Company, giving lists of places, and calling his attention to the waste. Asked what he suggested was the remedy for this state of things, witness said it was more efficient inspection. In many cases, the fittings were out of order—they had evidently been broken for some time; and considerable portions of the consumers' pipes in the small houses were exposed, and consequently would be the first things to freeze. Then they were not repaired for a very long time. He did not think the Company were quick enough after them. He did not believe there were any broken mains that could have caused the waste, because in the case of a fracture the water always, or nearly always, showed on the surface.

In cross-examination by Mr. PEMBER, witness said the Company should have a moderate control over fittings, as this was the only means of checking waste. The Company erected 80 special stand-pipes in Bethnal Green to meet the emergency; and there was a constant supply all day from them.

In re-examination by Mr. BALFOUR BROWNE, who referred witness to the Water-Works Clauses Act, 1863, and asked him whether ample powers to prevent waste were not given by that Act, witness replied that there were inspectors, who prosecuted in some cases; but they did not do enough in this direction.

Mr. *J. Foot*, one of the sanitary inspectors for the Bethnal Green Vestry, spoke to complaints of the failure of the water supply, which the local authorities were, he said, powerless to remedy.

Mr. *J. Lovegrove*, the Chief Surveyor to the Hackney Vestry, said there was great inconvenience during the period of frost in this district, from the freezing of the mains and service-pipes; and the Vestry had 36 of their own vans with syphons, so that they could run water into pails and vessels. The effect of the frost on the water-pipes involved the opening of the roads in a great many cases. There was as many as 1536 openings made between the 1st of January and the 30th of April; and 93 of these referred to the mains. The depths of the mains varied from 1 ft. 6 in. to 3 feet; and by far the larger number would be about 2 feet or 2 ft. 6 in. When the dry weather came, they could not water the roads as before, because the water-vans could not get water from the hydrants. But when the water did come on, the hydrants and water-vans were literally besieged by the inhabitants. The carmen were unable to proceed with their vans, owing to the people dipping their utensils into the vans. They said it was shameful that the water should be used on the roads when they had not sufficient for their use in the houses. It was in consequence of this that the General Purposes Committee ordered the road-watering to be stopped.

In cross-examination by Mr. CRIPPS, witness said that of the 1536 openings made during the frost, 93 referred to mains, and the rest would be consumers' pipes.

Mr. CRIPPS: Whatever leakage there had been during the frost would be gone when the drought came?

Witness: It would depend upon the absorbent character of the subsoil. Where we have a gravelly subsoil, leakage may continue for a considerable time, until supersaturation takes place, if the crust is hard; but if the crust of the road is somewhat soft, it shows at once.

Dr. *T. Taylor*, the Medical Officer of Health for Mile End, said that if there had been cisterns, the inconvenience would have been very much mitigated. Still it was not so good for a poor district as the constant supply—in fact, he objected to the cistern system *in toto*.

Mr. *J. W. Johnson*, the Sanitary Inspector of the Board of Works for Limehouse, said he represented a thickly-populated district of poor people. During the months of July and August, the soil-pipes were foul and offensive, and in many cases choked, owing to an insufficient quantity of water for flushing purposes. The supply was only given for two hours in the day.

Mr. PEMBER: Why did they not take the trouble to flush the pipes when the water was on?

Witness: They did do so; they have 2-gallon flushing-cisterns.

Dr. *Vaughan Ryegate*, the Medical Officer of Health for St. George's-in-the-East, and Mr. *W. Firth*, the Sanitary Inspector to St. Leonard's, Shoreditch, also gave evidence; and some other witnesses (non-official) related their experiences.

Mr. BALFOUR BROWNE said this closed his case. He thought he had proved scarcity; and he had tried to show the effect on health. He had also endeavoured to show the unfairness of manufacturers being put on the fire-mains, and getting their water, while other people were not. He had suggested the cause of the scarcity—viz., the enormous waste of water.

Mr. A. C. MORTON (for the West Ham Corporation) said he should like to have the opportunity of hearing the case of the Water Company; and, if necessary, he would then give evidence as to the cause of the scarcity.

Colonel DUCAT: Mr. Balfour Browne has put down what he says is the cause of the scarcity—the leakage, which he has proved. Have you any other grounds to suggest?

Mr. MORTON: No; but I want to have the power of giving rebutting evidence.

Mr. PEMBER: The limitations of the inquiry are to fact, cause, and effect.

Mr. BALFOUR BROWNE: And possibly remedy.

Mr. PEMBER: They must prove them all; I am not going to help them. As to remedy, when my own case comes on, I shall show that there is no remedy wanted.

The inquiry was resumed on Thursday; and the case for the London County Council was proceeded with.

Mr. *A. R. Binnie*, M.Inst.C.E., the Chief Engineer to the Council, was called, and examined by Mr. FREEMAN. He said he reported to the Council on the matter under consideration at the end of July last. He had endeavoured to discover the cause of the shortness of water at the East-end; and he had prepared tables, founded on the Official Water Examiner's reports, showing the total quantities supplied by the East London Company during the years 1892, 1893, 1894, and the first five months of 1895. During 1892, the average daily supply was 43,561,270 gallons; in 1893, it was 41,901,868 gallons; in 1894, it was 41,396,448 gallons; and in 1895, for the first five months it averaged 53,010,513 gallons. From 45,000,000 gallons a day in January, 1895, it rose to 59,000,000 gallons in February, 1895. Since that time the supply averaged 54,000,000 gallons during March; in April, 55,000,000 gallons; and in May, 51,162,000 gallons. In February, 1895, the supply was 59,155,000 gallons a day; and in February, 1892, it was 44,900,000 gallons. In March, 1895, it was 54,384,000 gallons; and in March, 1892, it was 44,892,000 gallons. In April, 1895, it was 55,326,000 gallons; and in April, 1892, it was 44,033,000 gallons. In May, 1895, it was 51,163,000 gallons; and in May, 1892, it was 42,913,000 gallons. In June, 1895, it was 51,335,000 gallons; and in June, 1892, it was 44,235,000 gallons. For the five months of 1895, the total excess from February to June over the preceding year was 1,501,232 gallons. The flow of the Lea was not in any way below the average; and the river yielded ample supplies of water. The witness then produced tables giving the excess supply to the district of the East London Company in the months from February to June, 1895, as compared with the maximum quantities in similar months in previous years. They showed that during this period a total quantity of more than 1501 million gallons of water was sent into the district, which, at the average rate of the maximum supply during similar months in previous years (which might be taken at a little over 44 million gallons a day), represented a supply for 34 days in excess of any previous quantities pumped into the district by the Company. Witness was next examined on a table supplied by the Conservators of the River Lea, showing the gaugings at Feilde's Weir during 1892-3-4, and the first five months of 1895, divided under the heads of "Maximum Flow," "Minimum Flow," and "Mean Flow" for each whole month. The minimum flow of any one day in January was 43·6 million gallons; in February, 51·3 million gallons; in March, 60·9 million gallons; in April, 44 million gallons; and in May, 27·8 million gallons. The "mean flows" per month were: January, 160·8 million gallons; February, 84·5 million gallons; March, 105 million gallons; April, 62·7 million gallons; and May, 43·5 million gallons. The mean average flow of the River Lea for January, February, and March, 1895, was 116·6 million gallons; and the average flow for March, April, and May was 70·4 million gallons. These figures he contrasted with the gaugings of the minimum flow of the River Lea at Feilde's Weir during the years 1874, 1884, 1887, and 1891, which were dry years. The mean of these three months in 1874 was 20,709,000 gallons; for the same three months in 1884, it was 33,657,000 gallons; for 1887, it was 23,927,000 gallons; and for 1891, it was 23,226,000 gallons. The year 1892 was a very dry one. The three consecutive driest months were July, August, and September, during which the mean daily discharges of the Lea were 43·9, 33·5, and 37·6 million gallons respectively, or an average of 38·3 million gallons; so that it could not be said the months of March, April, and May last, which averaged 70·4 million gallons, were an exceptionally dry period. He found that there was a much larger quantity of water being sent by the Company into their district in 1895 than in the corresponding period of previous years; and he had come to the conclusion that the cause of the shortness of supply was clearly not an insufficiency of water, as a larger amount was being pumped into the district than on any previous occasion. In January, there was nothing exceptional in the service of the Company; in February, the average daily supply was 14,255,000 gallons a day in excess of any previous record; and this excess supply continued down to June. Therefore the only conclusion he could arrive at was that in February something occurred which prevented the people getting that supply. They did not become more careless in their habits in 1895 than in any previous year. What happened was that there was a great frost; pipes became burst and broken; and he presumed they had not been repaired down to the end of June. This would amply account for the difference between the quantity of water sent into the district and that received by the consumers.

Mr. FREEMAN: Did the Company ever avail themselves to the full extent of their power to draw the water which they stated they had when before the Royal Commission?

Witness: Well, they have exceeded their power of drawing from the Lea during those months. They have not, however, availed themselves of their power to draw daily from the Thames 10 million gallons; from the gravel springs at Hanworth, 2 million gallons; and from the Company's existing wells in the Lea Valley, 11 million gallons. The large quantity in excess, of which I have been speaking, was taken from the Lea; and in June there was abstracted from that river, 58,894,000 gallons, and in July 49,639,000 gallons.

Mr. PEMBER: But that is for two Companies?

Witness: Yes.

Mr. FREEMAN: Have you any comment to make upon that?

Witness: I view with the gravest apprehension this continued large abstraction of water from the Lea. The Lea Valley has a population of over 180,000 persons; and, minimize it how we may, the people of London have to drink more or less the clarified sewage of those people.

Mr. PEMBER objected to going into the quality of the water.

Mr. FREEMAN then asked the witness to keep to the inquiry more closely.

Witness (continuing): The Duke of Richmond's Commission said that not more than 50 million gallons could be expected from the Lea Valley; but now they were taking a quantity largely in excess of that. Lord Balfour's Commission, in their report, said: "This abstraction of the water from the Lea by the Water Companies is, in our opinion, too great with the storage now in existence."

Mr. PEMBER said this was not a question of whether the Water Companies were justified in taking the water from the Thames or the Lea. The Inspectors had no more to do with that than if the present inquiry related to gas.

Witness: I was merely saying that, in exceeding the quantities cited by previous Royal Commissions, a great danger was being run.

Mr. FREEMAN: Can you see any other reason for the deficiency in the supply to the consumers than the leakage from the Company's pipes, and so wasting it?

Witness: I have no other means of accounting for it, especially taken in conjunction with the sudden increase in the supply in February.

The County Council have been blamed for opposing the Company's Bill of 1893; and thus preventing the carrying out of works which would have obviated this scarcity of water. What is your view?—That could not have affected this question, seeing that the works could not have been completed for a year or two. I have shown that the shortness of water was not caused from a drought at all; the Company have had an excess of water in those three months.

In cross-examination by Mr. PEMBER, witness said that during a frost it was a general thing to leave taps running; but this would not account for the excessive waste of water. He believed more water was lost by an intermittent than by a constant supply. A large excess of water was used during a frost. In other towns there was also a very serious waste of water during the frost. In East London, it amounted to about 20 per cent. The experience of the East London Company was no exception to that of water companies generally during the frost. He presumed that the leakages were going on to a large extent now. When the supply was cut off, as happened for the greater part of the day, water was saved, and therefore stored; and as it was not allowed to run through the mains, there was no waste. The fact that the reservoirs were full by the end of July, and the supply fell to the normal quantity, did not do away with his waste theory. The Company had a Bill for storage powers before the House of Commons. It was to give authority to construct a reservoir covering 90 acres, and to store the full quantities of water which the Company had a right to take day by day from the Lea. But the powers asked for were not granted. The proposal was to acquire fresh storage for 1200 million gallons of water. No further storage capacity was necessary in the Lea Valley, because, with the existing reservoirs, the whole of the supply furnished by the valley was practically exhausted. What the Company now possessed was sufficient to tide them over any season of drought, and keep up a daily supply of 30 million gallons of water. The London County Council opposed the Bill referred to. He recommended this course to be adopted, because he regarded the valley of the Lea as a constant source of danger to the Metropolis as a source of water supply. This conclusion was formed by him after the Royal Commission had reported as to the quantities that might be taken from that river, and after they had borne testimony to the very high standard of purity of the water. The sources of pollution of the Lea had not been removed; and sewage was still flowing into the river. When these sources of pollution were removed, they might reasonably discuss how much more good water could be drawn from the river.

Mr. FREEMAN then summed up the case on behalf of the London County Council. He said it was for the Company to show that the drought or the frost was the unavoidable cause of the failure in the water supply, and not concomitant circumstances attending thereon. That the failure was due to any drought, had been disposed of by the fact that the River Lea was in full volume at the time, and the Company pumped more water than was usual during the period referred to. The real cause of the dearth was the waste caused by the burst pipes; and it was well known that it was cheaper to pump water into the mains than to stop waste. Then it must not be forgotten that those who paid for water by meter had a constant supply; while those who did not were so negligently treated as not to receive any water at all. It was absurd to attribute the water famine to the action of the London County Council, because the Bill was rejected on important public principles—viz., the possible combination of all the Water Companies in one body. The fact was that the waste took place either in the mains of the Company or in the communication-pipes, for the fractures in either of which the Company were responsible.

The case for the County Council then closed, and that of the Company was opened. The further proceedings in the inquiry, which closed on Saturday, will be reported next week.

BIRMINGHAM CORPORATION WATER SUPPLY.

The Elan Valley Works—Further Parliamentary Powers—Conditions of Labour at the Pumping-Stations.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Alderman Fallows) presiding—the Water Committee presented a report which stated that the thorough renovation of the Aston filter-beds had been undertaken, at an estimated cost of £2250. The filtered water-pools at Aston had also been emptied and cleansed, at an outlay of £290. During the summer months, the resources of the department had been strained to the utmost to keep pace with the demand in the various districts; and considerable inconvenience to consumers had been caused at times. With their existing works, the Committee could not distribute larger quantities of water; and, in periods of pressure, it was absolutely necessary that strict economy should be practised. The Committee had had under consideration the hours of labour worked by the engine-drivers and stokers at the pumping-stations, and had resolved to adopt the system of eight-hour shifts from the beginning of October. The rate of pay had been, per day of twelve hours, for drivers 5s., and for stokers 4s. 2d.; and it would be lowered to 4s. 6d. for drivers and 4s. for stokers per day of eight hours. Existing drivers, however, would receive a special allowance of 2d. per day. Time-and-a-half rate for Sundays had been paid, and would be maintained. The holidays would be reduced to six days per annum, assimilating them to the level of other departments of the Corporation. It was estimated that the cost of the alteration would be about £1700 per annum. Under the head of Elan Valley works, the Committee reported that considerable progress had been made with the excavation in the base of the Caban dam and channels. The railway in the upper part of the valley had been completed as far as the site of the Pen-y-gareg dam, and was being continued to the Craig Goch dam. A commencement had been made with the excavation of the foundation of the Pen-y-gareg dam and the necessary river diversion. A start had also been made with the excavation at the submerged dam near Careg-ddu. The number of men employed in September on the works in the Elan Valley was 1003. By the Act of 1892, the provisions of the Railway Clauses Consolidation Act of 1845, with respect to the temporary occupation of lands during the construction of works (including the use of land for the deposit of spoil), were applied only to the railways and reservoirs authorized. The Bill, as originally drafted, extended the application of the Railway Clauses Act to the aqueduct; but this provision was struck out at the instance of the Lord Chairman of Committees, in accordance with a practice recently introduced by his Lordship. It had consequently been necessary to endeavour to acquire, by agreement, the sites required for the deposit of spoil from the aqueduct works. For the whole of the length already let, and for other sections, spoil sites had been acquired on terms more or less reasonable; but with regard to an important section now under negotiation, the prices asked by the owners of all the suitable sites were, in the opinion of the Committee, so excessive that they are unable to authorize their agents to acquire the lands on the terms named. The Committee were advised that little difficulty was likely to be experienced in obtaining parliamentary powers for the compulsory acquisition of definite sites, to be scheduled and indicated on plans to be deposited. They therefore recommended that application be made to Parliament, in the ensuing session, for an Act giving compulsory powers for the purchase or use of the necessary lands. For the construction of the reservoir, filter-beds, and other works at Frankley, a large quantity of stone, cement, and other materials would have to be conveyed from Rubery station. Under existing circumstances, these would have to be carted over hilly country roads at heavy expense. In the application to Parliament, it was proposed to ask for powers to construct a short railway from Rubery station to the property of the Corporation at Frankley, as the cost of conveyance by rail, even taking into consideration the expense of making the railway, would effect a saving as compared with cartage. The railway would be about a mile in length, and would pass wholly over the property of one landowner, with whom negotiations had been opened.

Alderman LAWLEY PARKER first proposed a resolution authorizing the Committee to take the necessary steps for the promotion of a Bill during the next session of Parliament, empowering the Corporation to acquire sites for the deposit of spoil from the aqueduct works authorized under the Birmingham Corporation Water Act, 1892, to construct a line of railway from Rubery Station to the site of the authorized reservoir at Frankley, and for other purposes. He said that, roughly speaking, the Committee required one or two acres of land upon which to deposit the spoil for every mile of aqueduct; and they had endeavoured to acquire sites by agreement with the owners, but some excessive prices were required. In purchasing the land for the aqueduct, they were asked £12,000 for a piece which they ultimately obtained under their compulsory powers for £2500. It was important, therefore, that they should obtain compulsory powers to acquire the land they needed for spoil banks. As to the short railway from Rubery Station to Frankley reservoir, when the reservoir was first projected, Mr. Gray was of opinion that a sufficient quantity of clay would be found on the site to make the lining, even if the soil was not of such an impervious character as not to require lining. But when Mr. Mansergh sank a number of trial holes, it was found that the quantity of clay there was comparatively small; and the quality was not of such a character as to encourage him to use it. It had therefore been decided to line the reservoir with concrete, with a surface of asphalte. For this some 200,000 tons of stone would be required; and it would have to be brought from two quarries in the neighbourhood of Rubery Station. The Committee were of opinion that, if the owner of the land (Lord Cobham) was prepared to deal on reasonable terms, and not to oppose the Bill, it would be economical to construct the railway in question.

Mr. LANE seconded the motion, which was unanimously carried.

Alderman PARKER moved the adoption of the Committee's report. Referring to the alterations in the hours of labour at the pumping-stations, he said the whole of the men were now fairly satisfied; and he believed the shorter hours would be a benefit to them and to their families, while more efficient service would be rendered to the department. With regard to the water supply, ever since he had been Chairman of the Water Committee, he had been called upon to preach to consumers the need for economy. He told them in June last that their resources were strained to the utmost. There was some relief in July and August; but he was sorry to say the position was as acute now as it ever had been. On the high levels, they found it impossible with their present resources to secure a continuous supply throughout the whole of the twenty-four hours; and he was afraid this difficulty would be a recurring one until they obtained the Welsh water.

Mr. BARBER seconded the resolution, which was passed.

The Uncovered Reservoirs at Southampton.—The Southampton Town Council have adopted the recommendation of the Works Committee and the Water Engineer (Mr. W. Matthews) that the two reservoirs on the Common be covered, at an estimated cost of £6000 (*ante*, p. 645); and application is to be made to the Local Government Board for sanction to borrow the amount for thirty years.

Brisbane Gas Company.—The financial statement of this Company for the half year ending June 30 last shows a net amount, with the balance brought forward, of £8033 to the credit of the profit and loss account. The Directors recommend a dividend of 4½ per cent., amounting to £6295. The payment of the dividend-tax of £315 would make this up to £6610—leaving £1423 to be carried forward.

Trial of Incandescent Gas Lighting at Sutton (Surrey).—The incandescent system of gas lighting has been tried in six of the public lamps at Sutton, previously fitted with 4-feet burners, each giving a light of 10 candles. The result was an increase to 80 candles when glass chimneys were employed, and to 60 candles with the mica chimneys which it was necessary to use. This is so satisfactory that the Surveyor to the District Council has advised a further trial of the system. By substituting 4-feet incandescent burners for the existing 7-feet ordinary jets, he reckons that a saving of 27s. 4d. per annum will be effected; and by using the same type of burner instead of a 5-feet jet, 7s. 1d. per annum would be saved. It has been decided to spend £40 in fitting thirty more lamps with incandescent burners.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held a meeting of some consequence on Monday. First on the list of business was the report of the Engineers, which showed an increase of 7,677,000 cubic feet of gas during August, as compared with the output in August of last year, and an increased output, since the 15th of May, of 14,038,000 cubic feet over the output in the same period of last year. The Commissioners next introduced a recommendation by the Works Committee as to the price of gas for a year from the survey which begins this month. This was to the effect that the gas should be of from 24 to 26 candle power; and that the price should be 3s. per 1000 cubic feet, subject to the usual rates of discount, and for public lighting 2s. 1½d. net per 1000 cubic feet. Last year's prices were 3s. 2d. and 2s. 3d. respectively.

In moving the adoption of the recommendation, Bailie Kinloch Anderson, the Convener of the Committee, said they were quite warranted in making the reduction, for they would recollect that last year there was a net profit of some £13,000; and out of this sum they had to give a very considerable contribution to taxation—not less than £2000. Therefore, he thought, they should be very careful in fixing the price of gas, so as not to have too large a surplus. The result of last year's working was that the Commissioners had an increase over the previous year of £16,531, which represented much more than 2d. on the quantity of gas consumed. But this year they were fixing the rate a little bit wide, in view of some very heavy expenditure they had going on. As they all knew, they were providing stoking machinery; and they had the expensive item of a new chimney at the Edinburgh works. These and several other items they proposed to pay out of revenue; their capital account would not be increased. Otherwise they might have been able to reduce the price of gas at any rate 2d. more. They had taken no account whatever, in their calculation, of the extra profit that would result from the working of the stoking machinery, which they were advised would save something like 1s. 3d. per ton of coal used. They wanted to prove the plant before they took that into account. Therefore they might have again a fair surplus at the end of the year; but it was exceedingly desirable to have a reserve fund, to save over-drafts from the bank. He therefore thought they were safe in fixing the price of gas as recommended. Mr. John Jamieson, in seconding the motion, said that while it was right to avoid having too large a surplus, all the dictates of prudence pointed to the advisability of their laying aside a substantial reserve fund. Last year, they had the largest increase they ever had in any year—about 104 million cubic feet. On a former occasion when they reduced the price of gas, they had an increase of 39 million cubic feet; and when they advanced the price to 4s. 6d., there was a diminution in the consumption which, he thought, showed that their great safety lay in a low price of gas. Lord Provost M'Donald thought they had great occasion to congratulate the Works Committee, and especially their Convener, who had a thorough grip of the gas business, which was an important thing for them. The recommendations of the Committee were then adopted.

Mr. J. Walcot, referring to a previous resolution of the Commissioners to make a display with incandescent gas lighting in front of the offices of the Commission, said he had always thought they did not do all they should do in this direction. They ought to make a good display, and show people what could be done with gas. The Lord Provost said he hoped that the remark would be taken into account.

Then followed a somewhat peculiar item. A letter from the Clerk to the Perth Gas Commissioners was read, in which it was stated that their Manager, on account of advancing years, had resigned office, which he had held for over 44 years, and that they were anxious to secure the best man possible; that they were willing to give him a proper salary; and they asked the experience of the Edinburgh and Leith Commissioners on several matters in connection with the appointment of a Gas Manager—including training, the duties required, and particularly whether he had any duties other than connected with the manufacture of gas, and the emoluments. The Lord Provost said the Works Committee would look at the letter, and would give them all the assistance they could. Bailie Kinloch Anderson said they would be glad to do it.

After this, the Commissioners took up the question which was raised by Mr. Mackenzie in the Town Council recently, regarding the clandestine testing of Edinburgh gas by a deputation from Liverpool. The Lord Provost said he promised in the Town Council to have the matter looked into; and this was their first meeting since. The great point upon which the question seemed to hinge was that the man who tested the gas had to give notice. That immediately suggested, to the uninitiated mind, that it was a hint that for the time being the manufacture of gas should be a little superior. He scarcely could take this view of it. He had been making a little inquiry; and, shortly stated, the result was that a place was needed for the purpose of making the test, and notice was required to be given in order that it should be ready for the official. If they could so modify the arrangement that the examiner could go at any time he liked, and even if he could take one or two districts in the town and test the gas there, he believed it would give confidence to the public. He did not for a moment believe that anyone in connection with the gas-works wanted to do anything unfair. That a man could bring an instrument in his portmanteau, or in his pocket, and test the gas, he was told was impossible. But if they were to take up the question, it must be taken up in all honesty of purpose; so as to give a fair return to the public. Bailie Kinloch Anderson said he had since learned that two tests were alleged to have been made—one on the Sunday night, when they were sitting in the Balmoral Hotel, and the other on the Monday. The Commissioners had no test on the Sunday—they gave their Analyst a rest on Sundays; but in respect of the Monday, he made it his business to see the book at the works, and the average of three tests that day gave 26-candle power. It was only fair to say—he wished to be candid in the matter—that their Analyst also tested the gas in the premises in which they were met, as well as at the works. He left on his holidays on that Monday, and an assistant did the work for him; and the tests that he made in the office showed just under 23 candles. They might put down the discrepancy to want of experience on the part of the apprentice; but both results were far above that stated by Mr. Mackenzie, and he had no doubt whatever that the tests they made were correct. They must be looked upon as really honest in their service. They bought the material to produce a gas of from 24 to 26 candle power. They had their analyses for the year, showing 24·91 candles for the twelve months, and 25·73 candles for the previous year, in Edinburgh; and 24·84 candles in the past year, and 25·55 candles in the previous year, in Leith. Could it be supposed that they would strike averages like this for the whole year if even at any time they had gas of the low candle power spoken to by Mr. Mackenzie? He agreed that suitable apparatus could not have been employed. He was told by experts in these matters that they could not get a correct result by this "snap-shot" method of testing the gas. The testing lay with the Corporation. Mr. Falconer King was not their official; he was the official of the Corporation. The Corporation might send him to half-a-dozen places in the city to test the gas. The notice which was given was in terms of the statutes. These provided that the tests should be made at the time when the gas was being supplied to the public. He did not know that the illuminating power of the gas varied during the day; but he believed that the gas varied in pressure. The Commissioners had notice, certainly, of the time when the examiner was to attend; but they did not get 24 hours' notice. Sometimes the notice came in the evening of the day before, and sometimes on the morning of the day of the test. But he was told by Mr. Mitchell that the gas made and sent to the holders could not have returned to the testing-place within 24 hours; so that it might be taken that there was no special distillation of coal for the purposes of testing. The examiner was not required to give 24 hours' notice; and he might say that if they received notice at nine o'clock in the morning that would be quite sufficient, as they could have everything ready for him in two hours' time. Mr. Cameron suggested that, when the gas was tested, the examiner should take two samples and seal them up, and that one should be sent to the Commissioners. The subject was then allowed to drop.

On Thursday, the Dean of Guild Court of Edinburgh granted warrant to the Edinburgh and Leith Gas Commissioners to erect their new chimney. The Commissioners, through Bailie Kinloch Anderson, adhered to their proposal to erect a chimney 250 feet high, instead of giving way to the suggestion of the Court and making it only 200 feet high. The site is about 40 feet to the south, and a few feet to the east of the present chimney; and the design shows one of the most handsome chimneys which it is possible to build, both as to configuration and the ornamentation in the shape of bands and fluted work. Not until it is completed will the old one be removed. It is not before its time that it should be taken down, as, I understand, it is still giving manifestations of the unsoundness of its foundation.

Mr. G. A. Alexander, son of Mr. Duncan Alexander, Superintendent in the Edinburgh Corporation Gas-Works, has been appointed as Assistant-Manager in the works of the Portobello Gas Company. Hitherto he has been employed in the office of Mr. Mitchell, Engineer and Manager of the Edinburgh works. On the occasion of his leaving that situation to enter upon his new duties, he was entertained to a smoking concert, which was held in the Canongate Institute on Wednesday night. Mr. Alexander's popularity in the works was shown by the fact that Mr. Mitchell took the chair at the meeting, and that about 200 of the workmen attended the entertainment in his honour. Besides this mark of esteem, he was made the recipient of valuable tangible gifts, in the shape of a silver-mounted inkstand and a case of drawing instruments from Mr. Mitchell; and of a gold albert and appendages and a writing-desk, from the workmen. He enters the Portobello works with one of the heartiest God-speeds any young man could receive.

The Corporation of Glasgow recently entered the market soliciting contracts for a supply of coal for the gas-works for the next six months. In the present state of the coal trade, with the miners producing more than they were ever before known to do, offers of all descriptions were specially abundant. The Gas Committee have consequently been able to conclude contracts for the full quantity they desired, at prices ranging from 6s. 6d. to 6s. 9d. per ton. The rates show little variation from what they did in January last, when contracts for the first half of the present year were entered into, or in June last, when further coal was bought. But, of course, they are greatly down from what they were a year ago. The fact that the Corporation have entered into contracts for six months, is a pretty certain forecast of the condition of the coal trade; the Gas Committee being as well advised in the matter as it is possible for any body to be. Had there been a prospect of prices rising next spring, it is unlikely that the period contracted for would have been limited to six months. If, on the other hand, there had been any likelihood of prices falling soon, the probability is that a shorter period than six months would have been fixed. The outlook would therefore appear, so far as the best judges are to be relied upon, to warrant the expectation of a steady market for some time to come.

The Dundee Town Council, on Thursday, discussed the proposal to go to Parliament to obtain an increase to their borrowing powers. In a flock, there is always one sheep behind the others. On this occasion, the position was filled in the Council by Mr. Speed, who opposed the proposal, and asserted that he had never heard that the borrowing powers of the Gas Department had been exceeded by £22,000. The fact was stated at the annual meeting in June, by Treasurer Ritchie, when presenting the accounts for the previous year; and the need for increased borrowing powers had been mentioned before. Mr. Brownlee, the Convener of the Gas Committee, on being called upon by the Lord Provost to explain how the matter stood, stated that they had a sum of about £45,000 at the credit of the sinking fund, which they were unable to apply to the purpose for which it was intended, on account of the want of borrowing powers, because they would see if they paid off their mortgage debt, they reduced their borrowing powers to that extent. They could not at the present time afford to do this. The consequence was that they were not only beaking the law, but taxing the gas consumers very considerably, in respect that the interest of the sinking fund was a charge against revenue, because it went to sinking fund itself; and they were therefore called upon to pay a larger sum—last year it was £1200 or £1300—

than they otherwise would require to have charged against revenue. He did not think that this was altogether a great evil, because it no doubt increased their capital to all the greater extent. At the same time, there was no question that the Gas Commission had been for a year or two practically water-logged for the want of borrowing powers. Whether they might stave it off this year or not—which, in his opinion, they should not do—it must be fairly met; and he thought it would be desirable, before any expense was incurred in this matter, that the Board should meet and have all the facts laid before them, and give their opinion as to whether they should go to Parliament this year or not. Certain it was they had exceeded their borrowing powers; and he did not think public men were called upon to take upon themselves these responsibilities. Notwithstanding this very sensible statement by Mr. Brownlee, Mr. Speed still objected; and after a good deal of discussion, consideration of the subject was adjourned.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 5.

Sulphate of Ammonia.—There has been a fair demand. But orders are still largely in the hands of dealers; and there is more sulphate offering, so that prices have been barely maintained. It may be noticed that values at the different ports continue to show considerable variation; quotations ranging from £8 15s. to £8 18s. 9d. per ton f.o.b. For forward delivery quotations, very little above spot prices are being assiduously circulated on the Continent by speculators, with what object is pretty obvious; since, beyond damaging spot market, they seem to gain nothing—buyers, in face of continuously falling prices, not responding very readily to overtures made to them.

Nitrate of Soda remains quiet. Fine quality on spot may be had at 7s. 10½d. per cwt.; and this is the full value of autumn shipment cargoes, ordinary quality.

LONDON, *Oct.* 5.

Tar Products.—The improvement mentioned in benzols last week has been maintained; and business has been done at slightly advanced figures, especially for 90's. Inquiries for benzols generally are also more numerous; and the bottom appears to have been touched. Pitch continues steady, and has no signs of weakness—rather the reverse. Creosote is more difficult of sale, and at easier prices; and, with the increasing output in front of the market, there does not seem much hopefulness of improvement. Values are now so low that, in many cases, it could be more profitably used as fuel, than sold as creosote. This is especially so in the Scotch district, where it is surprising that so little of the oil is used in this direction. Carbolic is quiet and lifeless, at about 1s. 6d. a gallon for 60's; and crystals are steady at their old figure. Anthracene keeps firm at last week's prices; and considerable business is being done. Prices are as follows: Tar, 18s. 6d. to 22s. Pitch, west coast, 35s. 6d.; east coast, 38s. Benzols, 90's, 1s. 0½d.; 50's, 1s. Solvent naphtha, 1s. 1d. Toluol, 1s. 1½d. Crude, 30 per cent., naphtha, 4¾d. Liquid creosote, 1⅛d. Naphthalene salts, 25s. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d.; 75's, 1s. 9d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia has slightly improved, but not to any remarkable extent. Buyers, however, are anxious to cover for forward delivery; and this in itself is a good sign. Prices realized during the week have ranged between £8 12s. 6d. and £8 17s. 6d., less 3½ per cent. Gas liquor is quoted at 6s. to 7s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The change in the weather will necessarily help to brisken up the demand for house-fire coal, and deliveries from collieries on account of contracts for gas coal will become heavier now; but so far the general position remains without appreciable improvement. In one or two instances, slight advances have this month been made upon the commoner classes of house-fire coals; but with these exceptions, October has opened with no upward move whatever upon the excessively low prices that have been ruling all through the summer. Pits also continue on short time, very few collieries as yet working more than four days per week, and heavy stocks are in most cases held. At the pit mouth, best Wigan Arley remains at about 10s. to 10s. 6d. per ton, Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; and common house coal, 7s. to 7s. 6d. There is a fair business doing in the lower qualities of round coal, for iron making, steam, and general manufacturing purposes; but the demand is far below the plentiful supplies offering. As a result, prices continue to be cut extremely low; and 6s. to 6s. 6d. per ton are about the full average figures obtainable for ordinary steam and forge coals. Only a limited inquiry comes forward for engine classes of fuel, with supplies plentiful, notwithstanding the slackness in the round coal trade; and very low quotations are made for contracts. The average selling prices remain at from 3s. and 3s. 6d. for common, to 4s. 6d. and 5s. per ton for best slack, at the pit. A depressed tone still prevails in the shipping trade, with only a very limited demand; and low prices are ruling. Ordinary steam coal averages 7s. 3d. to 7s. 6d. per ton, with some of the better qualities fetching 8s., delivered at the Garston Docks or the High Level, Liverpool.

Northern Coal Trade.—The coal trade of the north has been rather differently affected during the last few days; there being a falling off in the demand for steam coal, while that for gas coals has shown a satisfactory enlargement. The cessation of shipments to some of the northern ports, is the chief cause of dulness in the request for steam coals; and the highest price for best Northumbrian kinds is now 8s. 9d. per ton f.o.b., while sales at lower prices are noted. For second-class steam coals, from 8s. to 8s. 6d. per ton is now the current quotation; and steam smalls are rather scarce at 3s. 6d. to 3s. 9d. There is very little alteration in manufacturing coals; but negotiation has been commenced for next year's supplies, and shows so far a more than ordinary difference of opinion between producer and consumer as to the prices that are likely to rule. In regard to gas coals, the settlement of the contracts for the Newcastle Gas Company at 6s. 6d. per ton delivered, shows that the prices are 6d. per ton less than a year ago; and yet they are higher than they were some six months since. The Stockton gas coal seems to have been similarly bought. Deliveries of gas coal are now being steadily maintained, and give to some of the collieries fuller work than since the spring. The price for odd cargoes is rather steadier. In coke, there is a better demand for both distant and local gas furnaces; and the price may be put as at 13s. to 13s. 3d. per ton delivered at Middlesbrough, while export coke is quoted 14s. to 14s. 6d. per ton f.o.b. There is no alteration this week in gas coke; but the production is being enlarged, and in some of the inland centres there are still heavy stocks, though the demand is increasing.

Scotch Coal Trade.—There is not much variation to note since last week. A great quantity of coal is produced, and is perhaps moving off more freely then coalowners admit; but stocks are accumulating notwithstanding, and market prices remain low. The colder weather is expected, by increasing the demand at home for domestic purposes, to lessen the amount offered for export; and a slight increase in shipping rates might be looked for, were it not for the extra keenness of the competition by English coalowners, which has been experienced since the Scotch coal strike of last year. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 165,860 tons—a decrease of 2805 tons upon the quantity in the preceding week, but an increase as compared with the corresponding week of last year of 152,834 tons. For the year to date, the total shipments have amounted to 6,453,100 tons—an increase upon the same period of last year of 1,664,310 tons, but a decrease as compared with 1893 of 147,224 tons.

Reduction in Price of Gas.—The Directors of the Wellington Gas Company announce a reduction of 3d. per 1000 cubic feet in the price of gas to all consumers, as from the 29th ult. The present price will be 4s. 4d. per 1000 cubic feet, with a discount of 5d. if the account is paid by the last day of the month following each quarter-day. The net price will thus be 3s. 11d.

Sales of Stock and Shares.—Messrs. Richardson Bros., of Stamford, sold by auction, a few days ago, £980 of stock in the *Stamford Gas Company*. The stock was put up in £75 lots (including a dividend from Jan. 1 last); and the prices made ranged from £125 to £126 10s.——At Spalding on Monday last week, some £10 shares in the *Spalding Water Company* were sold at par, and a number of others were withdrawn at £9 17s. 6d. The shares, which are fully paid, are paying 6 per cent.; but the fall in prices is stated to be due to the last report being unfavourable. ——Last Tuesday there was sold £50 of *Dundee Corporation* 3½ per cent. gas debentures, at a price equal to 125¼ per cent.——The following sales were recorded last Saturday: Three £10 shares in the *Ashford Gas Company*, at £20 each; 70 ordinary £5 shares in the *High Wycombe Gas Company*, at an average of £12 per share; 70 ordinary £2 shares in the same Company, at £4 15s. per share; 30 ordinary £2 shares in the *High Wycombe Water Company*, at an average of £4 18s. per share.

The Water Revenue of Darlington.—The Chairman of the Water Committee (Mr. G. Marshall) informed the Darlington Town Council last Thursday that the profit on the water-works during the past half year only amounted to £221, after paying interest and redemption on capital. This was a decrease of £975 compared with the corresponding half of last year; and, assuming that the diminution continued, they would have to reduce very considerably the amount they had been accustomed to hand over in relief of the rates, which amounted to about 3d. in the pound. There had been a diminution of 36 million gallons in the water consumed for manufacturing purposes (which represented £654), as compared with the corresponding period of last year. Then there had been a considerable outlay on special repairs, due to the long and severe winter, and they had had to pump an additional 36 million gallons of water, for which they would obtain nothing. The additional expenditure had made great inroads into the £1200 they had in hand at this time last year. The consumption per head had been 22 gallons, as against 17⅞ gallons in the corresponding half year—no doubt due to people letting water run to waste during the frost.

The Public Lighting of Sydney (N.S.W.).—Whenever dissatisfaction is expressed with public lighting by gas, the complainers generally suggest the adoption of electricity; and should this medium be selected in substitution of the older method, the parties not unfrequently find that it would have been better not to have made the change. In Sydney (N.S.W.) there is a feeling adverse to gas, notwithstanding that the Australian Gas Company have proposed to reduce the charge for each street-lamp by 2s. 6d. per annum; and a conference of the Mayors of the suburban boroughs and municipal districts has been held to consider the proposal, and to "devise some more efficient and less costly means of lighting the public thoroughfares." After some talk, it was decided that a deputation of five Mayors should wait upon the Directors of the Company to discuss the subject. There is, of course, nothing unusual in this. But after the resolution had been passed, the Chairman (Alderman W. T. Poole, of Redfern) gave, at the request of the meeting, some information respecting the lighting of his town by electricity. He said his advice briefly was to make the best terms they could with the Gas Company. He would not advise them at present to go in for electric lighting, because electricity as a lighting power was only in its infancy; and he doubted if an installation in any of the boroughs could be made to pay. It certainly could not prove remunerative if devoted entirely to street lighting. The installation at Redfern had cost £19,000. The working expenses were roughly about £1500; the interest on the capital represented about £1000; and there was a sinking fund of from 2½ to 3 per cent. He could tell them plainly that had the Redfern Council illuminated the streets by means of gas, the cost per annum would have been £1820, whereas the ratepayers were now paying £2200 (being £1 per lamp per annum extra). He was by no means sure the penetrating power of the 25-candle electric lamps now in use at Redfern was as great as that of the old 16-candle gas lights. The matter stands over pending the report of the deputation.

The Ashford District Council and the Gas-Works.—At the meeting of the Ashford (East Kent) Urban District Council last Friday, the Finance Committee recommended that the Council should communicate with the Gas Company with "a reasonable view to purchasing the works." The recommendation was adopted without comment.

Extensions at the Tamworth Gas-Works.—Last Friday, the Chairman and Directors of the Tamworth Gas Company entertained to a banquet at the Castle Hotel, a number of shareholders, consumers, and managers of local gas-works in celebration of the completion of an extension of the gas storage and purifying plant, the contractors for which were Messrs. R. & J. Dempster, of Manchester.. About 30 gentlemen were present.

Torquay Gas Company.—Speaking at the meeting of this Company last week, Mr. W. H. Kitson, J.P., stated that the half-year's profits amounted to £4061, and that the dividends required £3186; leaving a surplus of £875. There had been an increase of £1252 in the sale of gas, and of £42 for public lighting; the number of public lamps having increased from 855 in 1894 to 880 in 1895. In residuals there had been a considerable falling off. Dividends were declared for the half year at the rates of 10 and 7 per cent. per annum.

The Price of Gas for Public Lighting at Barnsley.—Communications recently passed between the Town Clerk of Barnsley and the Secretary and Manager of the local Gas Company (Mr. W. W. Hutchinson) regarding the price of gas consumed for public lighting. The Town Clerk was instructed to apply for a reduction—a request which was regarded by the Council as reasonable in view of the "low price of coal." On behalf of his Directors, Mr. Hutchinson replied that they were aware that the cost of coal was now more moderate; but they reminded the Council that the extra expense (£2000) during the last coal dispute, which came entirely out of the pockets of the shareholders, had not yet been recouped them. The Directors hoped the result of the current year's working would enable them to make a reduction. The matter was mentioned at the meeting of the Town Council last Tuesday, when Alderman Wray informed his colleagues that the public lighting cost £2200 a year, which was a very serious item. It was also stated by Mr. Harvey that at Rotherham the Corporation had reduced the price of gas to 2s. 3d. per 1000 cubic feet. From the report to hand, it does not appear that the Council contemplate any further action in the matter at present.

Bexhill Water and Gas Company.—At the half-yearly meeting of this Company, the Directors reported that the net profit for the six months was £1311, as compared with £1006 in the corresponding period of 1894. It was recommended that a dividend at the rate of 4 per cent. should be paid, and £400 be carried to the contingent fund. The Manager (Mr. F. Russell), in his report, said there was a satisfactory increase of new water and gas services, and that the spring at Buckholt had not been affected by the continued dry weather. The balance-sheet showed that the total revenue from the sale of water was £1244, and from gas £1838. The principal items on the debtor side were £825 for coal, fuel, purifying materials, &c., and £440 for wages, repairs, maintenance, machinery, &c. The Chairman (Mr. R. Kersey) moved the adoption of the report. Referring to the proposal to carry £400 to the contingent fund, he said this was to provide for works which they anticipated shortly commencing. This was a course which was absolutely imperative, as their water supply was becoming very insufficient for their services. Their capital was now nearly all exhausted; and they had no other means of appropriating funds for such a purpose. The motion was carried unanimously.

The Price of Coke at Rotherham.—A long discussion was raised at last Wednesday's meeting of the Rotherham Town Council by a recommendation of the Gas Committee that authority be given for the sale of 800 tons of coke at a minimum price of 7s. per ton net between the present time and Dec. 31. The Chairman of the Committee (Mr. G. Gummer) made a statement on the subject, from which it appeared that he was absent when the recommendation was adopted; but, had he been present, he would have opposed a reduction to the extent suggested. He called attention to the fact that in August one of the largest consumers of coke in the borough made an application to enter into a contract for six or twelve months, to which the Committee replied that, "considering the better outlook of trade generally at the present time," they had decided to offer to supply the whole of the coke required by the applicant during the next six months at 9s. 3d. per ton, or for twelve months at 9s. 6d. per ton at the works, less the usual discount of 2½ per cent. monthly. He (Mr. Gummer) therefore now asked how it came about that, in a month's time, the Committee had resolved on a reduction to the absurd sum of 7s. per ton. He failed to see anything in the state of trade or in the increase of the stocks of coke that would warrant a Committee with any business ability at all in making such a reduction. Taking the estimated price of residuals as that now received, he found the total revenue for residuals for the year 1895-6 would be something more than £2000 less than last year. In the face of this, he thought they would make a mistake in reducing the price from 9s. 6d. to 7s. per ton. He considered a medium might have been taken, which would have given satisfaction to large and small consumers; and he moved, as an amendment, that the price be 8s. per ton. This was seconded by Alderman Neil. Mr. Hickmott, who was in the chair at the meeting of the Committee when the resolution was passed, stated that the general opinion of his colleagues—and it had been his own opinion for many years—was that the holding on to stocks of coke to the extent they had, and the cost in stacking the coke for more than one or two years, had been an unwise policy. A number of speakers followed on both sides. Mr. Jenkinson gave the information that at Sheffield the price of coke was 10s. 10d. per ton; and Mr. Hirst called attention to this wide difference in the proposals of the Committee: That while they were open to sell coke to manufacturers at 7s. per ton, they were suggesting that the working man should be charged 13s. 4d., which was an increase of nearly 4s. on the present price of 9s. 6d. He expressed his disapproval of the management of both the gas and water works, and said the sooner the Council went into the question the better. It was pointed out by Alderman Marsh that the price of 13s. 4d. was for bags of ½ cwt. delivered. The amendment was carried by nine votes to six

Gas-Meter Rents at Halifax.—Alderman Tattersall moved, at last Wednesday's meeting of the Halifax Town Council, an instruction to the Gas Committee to consider the advisability of dispensing with meter-rents. He thought that the amount of profit on the gas undertaking during recent years warranted this; and the reason he brought forward the resolution was because the bulk of the meters were rented by the poorer section of the community. The resolution was seconded by Alderman Brook, and passed.

Tavistock Gas Company.—The annual meeting of this Company was held yesterday week; the Chairman (Mr. H. T. Doble) presiding. The accounts showed that the rental from private lighting for the year ending June 30 was £1801; the receipts for the public lamps, £457; for coke, sulphate of ammonia, &c., £660; from meter-rents, stove hire, &c., £57; and an item of £180 for interest, made a total of £3158. The payments, including a dividend of £640, amounted to £2777; leaving a credit balance of £381. An interim dividend of 8s. per share was declared.

Water-Works for Worthing.—The Worthing Town Council have resolved to borrow £54,504 and £23,000 to defray the cost of the sewerage scheme and the water-works; a site for the latter undertaking having been selected on the advice of Mr. J. Mansergh, M.Inst.C.E. The money will be obtained from the Bank of England, in conjunction with Parr's Banking Company, and will be repayable in sixty half-yearly instalments (principal and interest combined) of £1406 7s. 7d. and £539 9s. 6d.; the borrowers to have the power to pay off the whole debt then due on Aug. 26, 1910.

The Public Lighting Contracts for Weybridge.—Referring to the report which appeared in the JOURNAL for the 17th ult. on this matter, the opinion of Counsel (Mr. Glenn) has since been obtained upon the proceedings of the District Council. It upholds the action of the Council on all points, excepting with reference to the gas-lighting contract; and, with regard to this, it is declared that it has no binding effect on either side, as it contains no clause as to penalties. At last Wednesday's meeting of the Council, it was agreed that a new contract with the Gas Company should be prepared, and submitted at an adjourned meeting.

The Finances of the Keighley Corporation Gas Department.—At last Tuesday's meeting of the Keighley Town Council, the Gas Committee reported that the gross profits upon the working of the gas undertaking for the year ending June 30 last (after lighting the public lamps free of charge) was £8931, from which had been paid interest on loans, £2798; provision for sinking fund, £1480; cost of fire brigade, £564; and cost of specifications for patents library, £16—making a total of £4859. This left a surplus of £4072; and the Committee recommended that £2000 of this should be appropriated in aid of rates, and £2072 in reduction of the debt on capital account. This was agreed to.

West's Retort-House Plant for Copenhagen.—The municipal authorities of Copenhagen have decided, upon the recommendation of their Engineer (Herr Irminger), to adopt stoking machinery at their gas-works. Herr Irminger recently visited several towns in England with the object of inspecting different systems of mechanical stoking; and the one decided upon is West's manual drawing and charging machinery, with engine and coal breaker, elevator, conveyor, and storage hoppers complete. The contract has accordingly been placed with West's Gas Improvement Company, Limited, who are also erecting at the same works some of West's improved regenerator retort-settings under a separate contract.

The Action of Thirlmere Water on Lead.—At a meeting of the Committee of the Manchester and Salford Sanitary Association last Wednesday week, it was stated that, at the instance of the Manchester Council for the Registration of Plumbers, the Association had undertaken to inquire into and report upon the action of Thirlmere water on lead, as it had been suggested that, owing to the soft character of the water, there might be a danger from its action on the service-pipes. The following report by Mr. William Thomson, F.C.S., was submitted: "I now send you my report on the Thirlmere water, which I was requested to test for its action upon lead pipes, and which I obtained from the Prestwich reservoir. I have ascertained that the water does not dissolve any metallic lead, and is, therefore, quite as safe as the former Manchester water."

East Stonehouse Water Supply.—The East Stonehouse District Council, who derive their water supply from the Plymouth Water-Works, have applied to the Corporation for the terms upon which an additional quantity over and above that stipulated in the local Act of Parliament can be supplied to their district. The Corporation Water Committee have decided to inform the District Council that they are prepared to afford a further supply when it can be furnished without detriment to the supply to existing consumers. They stipulate, however, that a specified weekly quantity, and not a variable amount, be taken. The water will be delivered through the existing North Road main until a new main for which provision was made in the East Stonehouse Water Act of 1893 is constructed. While it is delivered through the North Road main, the charge will be at the rate of 3d. per 1000 gallons, to be reduced to 2½d. when it is delivered through the proposed new main.

Water-Works Improvements at St. Helens.—Mr. F. H. Tulloch, one of the Inspectors of the Local Government Board, was engaged at St. Helens last Tuesday in considering applications by the Corporation for loans for various purposes. One of them was for £3000 for a new engine and alterations to the pumping-station at Eccleston Hill. The Town Clerk (Mr. W. J. Jeeves) explained that the Corporation were the owners of the water undertaking; and they required this money for improvements at the Eccleston Hill pumping-station. There were two engines, one of which was erected in 1852, and the other in 1862. The whole of the capital debt on the engines and buildings had been paid off. The engine erected in 1852 required repairs, which could be done out of revenue in the ordinary course; but the engine erected in 1862 was in such a condition that it was considered best to replace it with a new one on modern lines, which would effect a considerable saving in fuel, and enable considerably more water to be pumped. There was no opposition.

Lancaster Water Supply.—The Corporation of Lancaster have obtained power to borrow about £62,000 for the construction of a new reservoir at Bleatarn, which has been necessitated by the development of the town, and more especially of Morecambe. The work is to be commenced forthwith.

The Public Lighting of Bromsgrove.—Owing to the Bromsgrove Gas Company having declined to reduce their charge of £2 15s. per lamp a year for the public lighting, a Committee of the District Council recommended, at last Wednesday's meeting of the latter body, that the offer should not be accepted, and that a trial should be made of two or three oil-lamps. The Vice-Chairman (Mr. H. W. Lewis) thought the Council should be prepared to adopt temporary measures for lighting the town until they could devise some better plan either by means of electricity or otherwise. Mr. Fitch urged that the Company should be requested to reconsider their tender, and that a meter should be attached to a few of the lamps to ascertain the amount of gas consumed. The report was adopted by six votes to four. The Vice-Chairman said he should prefer to come to terms with the Company if possible; and he proposed that a deputation should be appointed to wait upon the Directors to endeavour to arrange for the supply of gas by meter. Mr. Bower seconded this proposal; and it was carried.

Heavy Consumption of Water at Manchester.—The ratepayers of Manchester have good cause for congratulation in having become possessed of the Thirlmere water before the recent long spell of hot and dry weather. The average daily supply has recently been greatly in excess of the corresponding period of last year; but so plentiful is the supply under command, that the Committee have not experienced the slightest difficulty in meeting the exceptional demand. The average consumption for the eight months ending Aug. 31, was at the rate of 29 million gallons per day. For the whole of last year, the average was 25 million gallons per day; so that, without taking the circumstances of last month into consideration, there has been an increase of 4 millions daily in the average consumption. The average daily output in the last week of September rose to above 31 million gallons; and yesterday week it still further increased to 33 millions. Had it not been for the Thirlmere supply, it would have been quite impossible to have distributed such a vast quantity of water; and it would have been necessary to impose restrictions upon consumers.

West Gloucestershire Water Company.—According to the report submitted at the half-yearly meeting of this Company last Saturday week, there were laid, during the six months ending Aug. 31, 228 additional services; making the number of houses and other properties supplied 5541, which, together with some meter and miscellaneous supplies, are estimated to produce a water-rental of £4360 per annum. In common with almost all water-works in the kingdom, the Company's mains suffered greatly from the unprecedented frost in the early part of the year; and their repair cost £315. The profit of the half year was £754, which made, with the balance brought forward, £1022. From this, the Directors recommended the declaration of a dividend (less income-tax) at the rate of 2 per cent. per annum. After the payment of this, there would remain £322, against which the entire cost of repairing the damage done by the frost has been debited. The Chairman (Mr. Enoch Horton), in moving the adoption of the report, said that several new streets and roads were being opened up in the Company's district; and building operations were being carried on vigorously. Owing chiefly to this, it was of the greatest importance that the Company should spend a further £3000 or £4000. The motion was carried.

The Purchase of the Odessa Water-Works by the Municipality.—An extraordinary general meeting of the Odessa Water-Works Company was held on Monday last week, at the Cannon Street Hotel, for the purpose of confirming the following resolutions, which had been previously passed at an extraordinary meeting held on the 12th ult. (see *ante*, p. 600): (1) "That the concession of the Company for the supply of water to Odessa, with such of the property of the Company as the Directors may determine, be sold to the Odessa Administrative Council, or other body representing the Municipality of Odessa, on the basis of a capitalization of the net annual receipts, taken for the purpose at 200,000 roubles for the residue unexpired, at the date of sale, of the term of the said concession, and otherwise upon such terms as to time for payment and upon such conditions as the Directors and Municipality may agree; and that the Directors be, and they are hereby, authorized to enter into a contract for, and carry out such sale;" (2) "That, in order to permit of the distribution of the proceeds of sale of the Company's concession and other property, the Odessa Water-Works Company, Limited, be wound up voluntarily; and that the present Directors be appointed Liquidators for that purpose." The chair was occupied by Sir Peter Spokes, who briefly moved the resolutions. A long and exceedingly acrimonious discussion followed, in the course of which some strong language was indulged in at the expense of the original promoters of the concern; but eventually the resolutions were adopted by a majority of those present. The Chairman intimated that he held a very considerable number of proxies in favour of the resolutions, for which, however, in view of the vote of the meeting, there was no use.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 718.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or F'all in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	24–25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	10	16–17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼–7⅝	..	4 3 10
40,000	5	,,	6½	Do. New	4	5¼–5⅝	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253–258	..	4 13 0
180,000	,,	,,	9	Do. New	100	207–212	+4½	4 4 11
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	222–227*	..	4 16 10
933,500	Stck.	29 Aug.	5	Bristol	100	125–130	..	3 16 11
320,000	20	27 Sept.	11½	British	20	54–55*	..	4 1 10
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½–22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½–17½	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8–8½	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101–104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31–33	..	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	305–310	..	4 7 1
165,000	,,	,,	10½	Do. New do.	100	225–230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143–147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	275–285	+5	4 11 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	207–212	..	4 14 4
535,000	Stck.	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	125–130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25–26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17–18	..	4 14 3
5,646,590	Stck.	14 Aug.	12½	Gaslight & Coke, A, Ordinary	100†	293–297	..	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107–112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	282–287	..	3 9 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135–140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200–205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193–198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282–287	+2	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf..	100	167–170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135–140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145–150	..	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	202–207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	249–254	..	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¼–6¼	..	4 16 0
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113–116*	+1	4 6 2
541,920	20	12 June	5	Monte Video, Limited	20	18–19	..	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	7¼–7⅝	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5–5⅛	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½–2½	..	8 0 0
420,000	100	2 May	6	People's Gas of Chicago—1st Mtg. Bds.	100	108–112	+2½	5 7 1
500,000	100	4 June	6	2nd Do.	100	102–107	+2	5 12 1
150,000	10	26 Apl.	7	San Paulo, Limited	10	11–12	+½	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370–375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	310–315	+3	3 16 2
308,685	,,	,,	13	Do. C do.	100	325–330	+5	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174–177	..	2 16 6
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230–235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	292–297	..	3 7 4
1,719,514	Stck.	10 Apl.	7†	East London, Ordinary	100	223–227	–½	3 1 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157–162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118–122	+½	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303–308	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260–265	+1	3 16 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208–213	..	3 10 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143–148*	..	2 13 4
500,000	100	14 Aug.	12⅝	New River, New Shares	100	385–395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143–148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147–152	..	2 12 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140–145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	293–298	+3	3 7 1

*Ex div

† Next dividend will be at this rate.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

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ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works

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*** See Advertisement p. II., centre of JOURNAL.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

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HYDRAULIC AND GAS ENGINEERS,

BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

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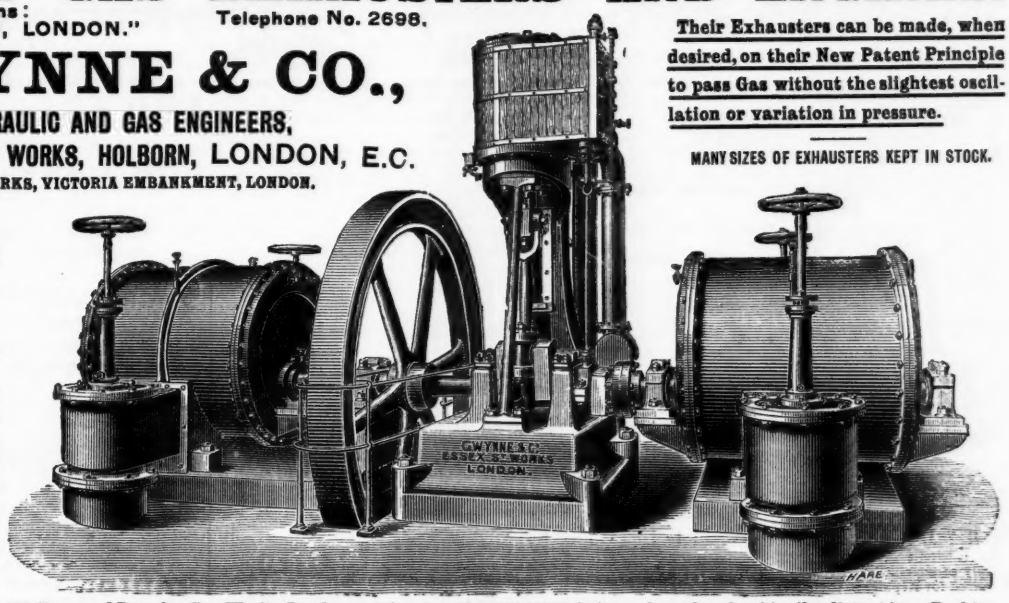

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NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
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Two or three times as rich as Bog Ore.
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Less than half the price of Bog Ore.
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PATENTS FOR INVENTIONS.

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BACK-PRESSURE IN PURIFIERS.

THE Valve invented by Mr. Cripps for Bye-Passing any Layer of Purifying Material referred to by the President of the Incorporated Institution of Gas Engineers in his Inaugural Address) can be obtained of the Makers: C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP, and J. EVERY & SON, Phœnix Iron-Works, LEWES, to which Firms all inquiries should be addressed.

GAS-FITTER wanted. None but best hands need apply, and who are used to Compo. and Mains and Services.
Apply, with references only, to No. 2574, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, a steady respectable Man as STOKER in a Small Works, where two are kept. Must be used to Engine and Exhauster, and a good Shovel Charger. Constant place to a steady Man. Wages, 24s. 6d. per week in Summer, and 26s. 3d. in the Winter.
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JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

THE Undersigned is in a position to supply, at the very lowest Prices, the most suitable kind of BENZOL for enriching Gas, made from Hardman's Patent Carbonization Process, of which I am the Sole Patentee. On application, I would furnish Price on the most reasonable terms; giving advice how to utilize it on the most economical method.
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TO ENGINEERS AND MANAGERS.

MR. J. L. FEATHERSTONE (late Chief Draughtsman to Humphreys and Glasgow) is prepared to supply complete WORKING DRAWINGS SPECIFICATIONS, and QUANTITIES for WATER-GAS PLANT. Own design.
Also DRAWINGS, TRACINGS, &c., of COAL GAS PLANT; Specially prepared for work wanted in a hurry. Moderate Charges.
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Apply to C. W. GRIMWOOD, Sudbury, SUFFOLK.

YSTRAD GAS AND WATER COMPANY.

WANTED, a good Gas-Fitter and PLUMBER. Wages, 7½d. per hour. Applications in own hand-writing, stating Age and full Particulars of work accustomed to, together with *copies* of Testimonials to be sent to the undersigned on or before the 15th inst. One accustomed to the work of a Gas-Works preferred.
ALBERT R. CAWLEY,
General Manager.
Gas and Water Offices,
Pentre, R.S.O., Glam.

COUNTY BOROUGH OF SALFORD.
(GAS DEPARTMENT.)

OUTDOOR SUPERINTENDENT.

THE Gas Committee are prepared to receive APPLICATIONS for this APPOINTMENT from Persons who have had the supervision of the Main and Service Laying of a large Gas Undertaking. Salary, £150 per annum.
State Age and Experience, and send three recent Testimonials, addressed to the Chairman of the Gas Committee, Town Hall, Salford, before Five p.m. on Thursday, the 17th inst.
Canvassing will disqualify.
By order,
SAML. BROWN,
Town Clerk.
Town Hall, Salford,
Oct. 2, 1895.

WANTED, to purchase, a new Main-layer's HAND-CART, without Cover.
Apply to T. WIGFIELD, Moor Gate, ROTHERHAM.

STATION Meter for Sale, having been replaced by a much larger one. The Meter is in excellent Working Condition, with Clock, Tell-Tale, Bye-Pass Valve, 6-inch Connections, complete, with two Cup-Valves.
Apply to THOS. WIGFIELD, Moor Gate, ROTHERHAM, Secretary to the Elsecar Gas Company.

OAKHAM GAS COMPANY, LIMITED.

THE Directors of the Oakham Gas Company, Limited, invite TENDERS for the surplus TAR and AMMONIACAL LIQUOR during the Year ending Sept. 30, 1896, delivered into Purchaser's Tanks at Oakham Station.
Coal Carbonized, about 850 Tons.
Tenders to be addressed to the undersigned, from whom all Particulars may be obtained.
JAS. MASON, Manager.
Oakham, Oct. 5, 1895.

BOROUGH OF NELSON.
(GAS DEPARTMENT.)

THE Gas Committee of the above Corporation invite TENDERS for the surplus TAR produced at their Works for a period of Twelve Months commencing on Oct. 1, 1895.
Forms of Tender and further Particulars may be obtained from Mr. W. Foster, Gas-Works, Nelson.
Sealed tenders, endorsed "Tar," to be sent to me the undersigned on or before the 15th day of October, 1895.
By order,
R. M. PRESCOTT, Town Clerk.
Town Hall, Nelson,
Oct. 2, 1895.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.), required for Repairs at their Neepsend and Effingham Street Stations during the next Twelve Months.
Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered by post, addressed to the undersigned, not later than Saturday, Nov. 2 next.
HANBURY THOMAS,
General Manager.
Commercial Street, Sheffield,
Oct. 5, 1895.

TO CHIMNEY-STALK BUILDERS.

EDINBURGH AND LEITH CORPORATIONS GAS COMMISSIONERS.

THE Gas Commissioners are prepared to receive OFFERS for the Erection of a New BRICK CHIMNEY STALK at their EDINBURGH WORKS, NEW STREET. The Stalk will be 250 Feet high above the Ground-Line.
Specifications and all Particulars may be obtained by applying to Mr. Robert Mitchell, Engineer, at the Works, where Plans may be seen and the Site inspected.
Sealed tenders to be lodged with the undersigned not later than Monday, Oct. 14, at Ten a.m., endorsed "Tender for New Chimney-Stalk."
The Commissioners do not bind themselves to accept the lowest or any offer.
JAMES M'G. JACK, Clerk.
25, Waterloo Place, Edinburgh,
Oct. 3, 1895.

BOROUGH OF BURTON-UPON-TRENT.

FIRE-CLAY GOODS.

THE Mayor, Aldermen, and Burgesses of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the supply of the FIRE-CLAY RETORTS, BRICKS, and CLAY required at the Gas-Works during the Year 1896.
Full particulars of the Specification and Conditions, with Form of Tender, may be obtained on application to the undersigned, to whom sealed tenders, endorsed "Fire-Clay Goods," must be delivered on or before Friday, the 25th day of October inst.
The lowest or any tender will not necessarily be accepted.
F. L. RAMSDEN,
Manager and Engineer.
Gas and Electric Light Works,
Burton-upon-Trent,
Oct. 4, 1895.

WOLVERHAMPTON GAS COMPANY.

SALE OF £15,000 NEW ORDINARY STOCK.
BY ORDER OF THE DIRECTORS, AND PURSUANT TO THE WOLVERHAMPTON GAS ACT, 1893.

MR. H. J. LLOYD will Sell by Auction, at the Star and Garter Hotel, Wolverhampton, on Wednesday, Oct. 23, 1895, at Four o'clock precisely, in Lots of £100 each,
£15,000 NEW ORDINARY STOCK OF THE WOLVERHAMPTON GAS COMPANY.
The Standard Dividend authorized by the Wolverhampton Gas Act, 1893, on this Stock is 6 per cent., subject to the usual Sliding-Scale Clauses. The Maximum Rates of Dividend upon the Ordinary and Preference Capital of the Company have been paid since the incorporation of the Company in 1852.
A Deposit of 10 per cent. upon the Purchase-Money will be payable at the Sale, and the Balance on the 31st day of December next, from and after which date the Stock will be entitled to Dividend.
The Sale will be subject to a Reserve Price, notice of which will be given to the Board of Trade before the day of Sale.
For further Information, application may be made to the SECRETARY of the Company; Messrs. NEVE, CRESSWELL, and SPARROW; and Messrs. MANBY and SON, Solicitors, WOLVERHAMPTON; or to the AUCTIONEER, WOLVERHAMPTON.

Price 15s., Limp Cloth, the Fifteenth Yearly

ANALYSIS OF THE ACCOUNTS
OF THE
Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to Gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the Year ended December 31, 1894, or March 31, 1895, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the Year ended December 31, 1894.

Compiled and arranged by
ALFRED LASS, F.C.A.

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Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

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PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

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Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

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SILICA BLOCKS, BRICKS, AND CEMENT
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FOR GAS-FURNACES.
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Strongly recommended where EXCESSIVE HEATS have to be maintained.

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PIPES.
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The Incandescent Gas-Light Company, Limited, Hereby Give Notice, that they only supply their Mantles subject to the following express Conditions, which are printed and pasted on each box:—

"The Incandescent Gas-Light Company Limited, in supplying the Mantle contained in this box, grant a Limited License to the purchaser to sell or use the same on the express condition that neither the purchaser nor any other person into whose hands the same may come shall use or sell the said Mantle except in connection, or for use, with Burners sold or supplied by the Company; any other sale or use will amount to Infringement of the Company's Patents. The Company supply Mantles for the purpose of renewals at the nominal price of 1s. 3d., subject to the Conditions and Limitations above set forth."

In the case of *The Incandescent Gas-Light Company, Limited v. Cantelo*, **Mr. Justice Wills upheld the Validity of these Conditions and Limited License; and, in the course of his Judgment, said:—**

The patentee has the sole right of using and selling the articles; and he may prevent anybody from dealing with them at all. Inasmuch as he has the right to prevent people from using them or dealing in them at all, he has the right to do the lesser thing—that is to say, to impose his own conditions. It does not matter how unreasonable or how absurd the conditions are. It does not matter what they are if he says at the time when the purchaser proposes to buy, or the person proposes to take a license: 'Mind I only give you this license on this condition;' and the purchaser is free to leave it or take it as he likes. If he takes it he must be bound by the condition."

In the case of *The Incandescent Gas-Light Company v. Hirschfeld and Others*, **the Honourable Mr. Justice Romer certified that the Validity of the Plaintiffs' Patents was established. Infringers in future will be liable to costs as between Solicitor and Client.**

(Signed) **FAITHFULL & OWEN,**
Solicitors for the Incandescent Gas-Light Company, Limited.

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Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

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Prices and Analysis on application.
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NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
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RAISED AT
The Wharncliffe Woodmoor Colliery,
BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1).	1·276
Weight of One Cubic Foot.	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter.	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash.	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.
Gas-Works, Cheltenham, 8th August, 1894.

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Wharncliffe Woodmoor Colliery Co LIMITED
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1 cwt. equals 3 cwt. of RED LEAD.
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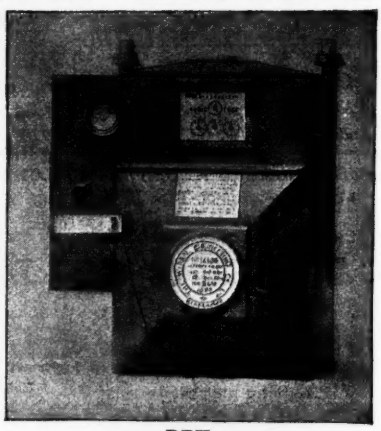
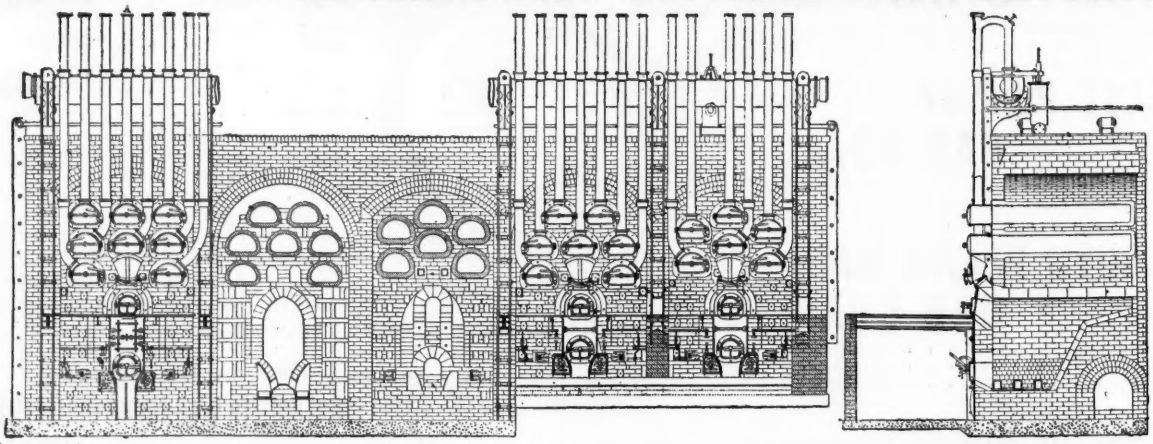

DRY.

Particulars on Application to the COMPANY, 76, Hamilton Street, BIRKENHEAD.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

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Illuminating Power . .	16·9	Candles.
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Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

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Coke (of good quality) . .	67·5	per Cent.
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Swansea	700,000 ,,	Bath	1,000,000 ,,
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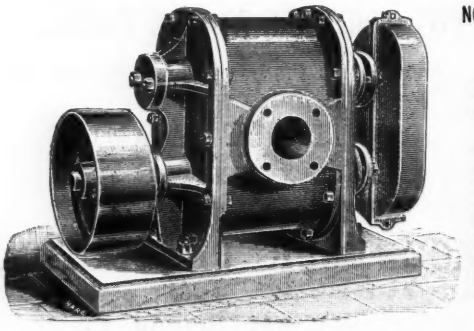

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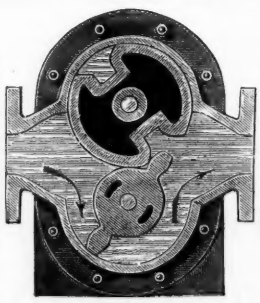

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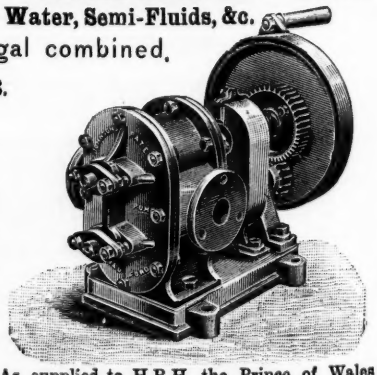

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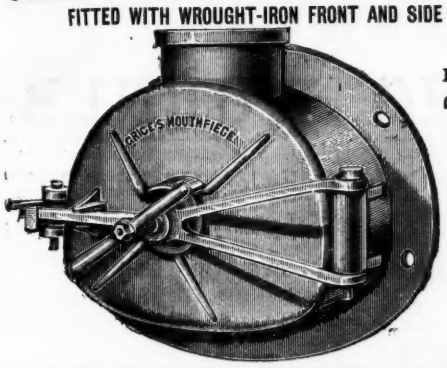

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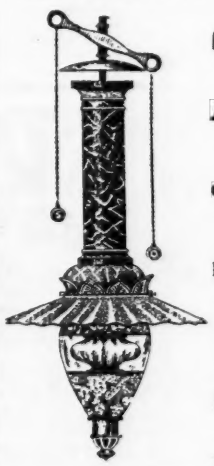

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[See also Advt. p. 714.

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